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North Carolina Natural Heritage Program Report



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NORTH CAROLINA NATURAL HERITAGE PROGRAM



North Carolina Department of
Natural and Economic Resources

The Nature Conservancy



DEPARTMENT OF NATURAL
AND ECONOMIC RESOURCES



P. O. Box 27687
Raleigh, N. C. 27611

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PREFACE

This report on the purpose and progress of the North Carolina Natural Heritage Program is prepared in fulfillment of contract requirements and as a basis for discussion. The Natural Heritage Program has completed its first year of operation. All expectations of the Program and obligations of The Nature Conservancy to the State of North Carolina have been met or exceeded. The following report describes the origin and purpose of the North Carolina Natural Heritage Program, the methodology, the approach to the identification of significant natural areas, progress and results of the first year, evaluation and recommendations for natural areas protection, and recommendations for continuation of the Program in its demonstration stages.

We have prepared this report at the twelfth month of the Program's operation, although the contracts between the State of North Carolina, Bureau of Outdoor Recreation, and The Nature Conservancy have been amended to extend the pilot stage of the Program from twelve to sixteen months. The extension will provide a transition period for the Natural Heritage Program to shift from its pilot inventory stage to its demonstration stage. The transition period will also permit the State of North Carolina, the Natural Areas Advisory Committee to the Department of Natural and Economic Resources, and other interested individuals to examine the progress of the Program and discuss the most advisable directions for the North Carolina Natural Heritage Program. We are hopeful that the four month period of contract extension will enable the state to decide the proper institutional arrangements for the Natural Heritage Program and to find funds necessary to continue the Program. This report aims at contributing to the discussion and evaluation of the Program required to determine its future directions. The major accomplishments of the Natural Heritage Program and major advances in natural areas protection in North Carolina are just ahead.

This report is prepared by the staff of the North Carolina Natural Heritage Program and the national office of The Nature Conservancy.



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INTRODUCTION

BACKGROUND: The North Carolina Natural Heritage Program was formed by a cooperative agreement between the North Carolina Department of Natural and Economic Resources and The Nature Conservancy, a private, non-profit organization devoted to the preservation of natural diversity through land conservation. The contract for the first year was funded at \$120,000 by the Babcock and Reynolds Foundations and the Federal Bureau of Outdoor Recreation. Similar programs are underway in four Southeastern states and proposed in two others.

PURPOSE: The Natural Heritage Program establishes a comprehensive, ongoing inventory of the state's natural diversity and plans for protection of significant natural areas. The Program systematically inventories locations of endangered and threatened plants and animals, special habitats and plant communities, unique geologic and aquatic features, and identifies outstanding natural areas. This information is applied to improve management of natural areas in public ownership, environmental assessment and development planning, protection planning, and public educational service. The Program will facilitate the rapid and effective use of ecological data in a manner never before possible.

The Natural Heritage Program works in cooperation and conjunction with the Division of State Parks and Recreation and all other resource divisions of DNER, the Wildlife Resources Commission, State Museum of Natural History, state universities, and federal land management agencies. Natural features information is made available for the use of public agencies, public works planners, local governments, scientific research, educational and conservation programs. The Program provides for timely input of ecological information in decision processes, and serves to avoid unnecessary natural resource conflicts or destruction of significant ecological features. As more state programs are added to the system, each state increases its capabilities to better evaluate natural areas for a more efficient allocation of limited conservation resources.

PROGRESS: The North Carolina Natural Heritage Program has proven the value of having an accessible, efficient, and economical data management system. The Program has earned the support of the academic community, conservationists, and public managers of natural resources. The Program has established its data management system (mapping,

manual files, computer file), has recorded over 3,500 natural element occurrences, has begun protection planning, environmental impact assessment, and analysis of existing protection capabilities within the state. The data system serves many and diverse users and has begun to fulfill numerous requests for information.

THE NATURE
CONSERVANCY
COMMITMENT:

The Nature Conservancy is committed to increased involvement in North Carolina. It has helped acquire 65,000 acres of natural lands for public preserves in the state since 1970 and is anticipating greater protection efforts here. The Nature Conservancy has established a branch NC Nature Conservancy, with a professional staff and growing membership, to act with public agencies and other conservation organizations to accelerate preservation of important natural areas and to adopt the broadest range of private and public incentives for enhancement of North Carolina's natural heritage. The Nature Conservancy will determine its protection priorities on the basis of evaluations made by the State Natural Heritage Program.

PURPOSE OF THE NORTH CAROLINA NATURAL HERITAGE PROGRAM

The Need

The pace of unplanned development of the North Carolina landscape is destroying, damaging or endangering the dwindling supply of remaining natural areas, ecological communities and species, landscape features, outdoor amenities and related elements of the state's outstanding natural heritage. Our enviable natural heritage is threatened with gradual obliteration. This lamentable situation is largely unnecessary since there are nearly always alternatives to this destruction, but only if decision-makers are well-informed. At present, there is a lack of (1) sufficient information about the status of the state's diversity of natural elements; (2) adequate methods for evaluating this information and setting sound priorities; and (3) a balanced and practical system for efficiently and effectively protecting the recognized critical areas.

The Nature Conservancy has been working cooperatively with the State of North Carolina's Department of Natural and Economic Resources in the acquisition of important natural and recreational lands. Recently both organizations and a number of enlightened citizens have concluded that, though this cooperation has been beneficial, it is necessary to establish, both in the state government and the private sector, an ongoing statewide program to insure that the unfinished business of protecting the state's rich natural heritage continues in a systematic manner. The North Carolina Natural Heritage Program is a comprehensive attempt to determine the state's most significant natural areas, through an intensive statewide inventory. The Heritage Program can assure effective allocation of resources, while avoiding development conflicts.

Program Description

In order to create an integrated approach to the process of land preservation, The Nature Conservancy has created the State Natural Heritage Program. The goals of the program are to provide a systematic basis for identifying elements of natural diversity and to protect examples from adverse impact. The Nature Conservancy contracted with the state to develop an overall system to coordinate the processes of ecological inventory, systematic data management and analysis, and the implementation of protection programs. The state derives a registry of natural elements describing its rarest and most threatened species and natural features. Beyond the pilot year, the system itself continues to operate indefinitely, adding or modifying information, revising priorities, and accomplishing the preservation of ecologically significant land.

The value of the Conservancy's assistance in setting up this program within the North Carolina state government is that it potentially brings tremendous protection capabilities to bear. Furthermore,

ecological information gathering and record keeping cannot be adequately dealt with in a short period of time, and only public agencies have the resources required for reliable long-term maintenance of the data system.

The Natural Heritage Program is divided into three major phases, each of which is divided into a series of tasks. These phases are: (1) program development; (2) the pilot inventory program; and (3) protection planning.

Program development is devoted to the establishment of the Heritage Program operations and includes hiring and training an in-state program coordinator, setting up the office, completing an ecological classification, establishing data flow patterns and data management system, and planning for ongoing operations.

The pilot inventory program commences the actual gathering of data, its processing and analysis. Of course, a good deal of information has already been collected in the state through the efforts of the DNER and other agencies, and it will be reorganized and systematized during the early part of this phase. At the end of the pilot program, reports will be generated which display available data and present preliminary conclusions. Continuation of the program by the state, however, will permit constant refinements and expansion of capabilities.

The third phase, protection planning, entails comparing an ongoing national survey of the best preservation techniques being employed to a survey of existing North Carolina programs and legislation. On the basis of this review, a series of recommendations are presented on alternative strategies for enhancing the protection of natural areas within the state.

Program Composition

Concept:

The Natural Heritage Program was conceived as a sophisticated, yet economical, data management system capable of providing the State of North Carolina with an information tool for use in natural area decision-making. The intent of the Program was to provide for protection of the irreplaceable components of North Carolina's natural diversity by making needed natural diversity information available.

The cooperation between The Nature Conservancy and the State of North Carolina is an innovation. The methodology of the Heritage inventory is an innovation also. A major shortcoming of most previous inventories has been the limitations imposed by arbitrary site-by-site methodology. Each site is unique, due to unduplicated characteristics or the combination and spatial distribution of its habitats, species, and other components. In an attempt to resolve the problem, many inventories have relied upon less-than-satisfactory quantitative evaluation systems. Frequently, the result has been to submerge consideration of natural diversity while allowing broadly applicable measures—such as degree of disturbance or size of scenic values—to assume overwhelming

importance. Thus a limited spectrum of ecosystems, landscape types or elements which are well represented may become frequent objects of preservation interest, while the few remaining examples of truly endangered elements may be passed over.

In order to avoid such problems, the Heritage Program focused first on the elements of diversity themselves. (An element of diversity, as defined by the Heritage inventory, is a natural feature of particular interest either because it is unique, exemplary, or endangered state or nationwide.) A classification of element types was developed, including plant communities, aquatic types, geologic features, and endangered and otherwise special plant and animal species. The list can be expanded by addition or subdivision of elements or be incorporating new classes of elements whenever it is deemed necessary. By dividing the nominated natural area sites into their components, it is possible to create an element-based inventory in order to collect and compare reported occurrences of a particular element type.

The element file structure provides an index of relative rarity by showing the number of reported occurrences, and the index becomes more accurate as the system gains data. For this reason, it is important to bear in mind that the Heritage inventory is an ongoing process, through which data are continually added to be modified, updated, and reanalyzed. As more information is added and the data base is updated and refined on a continuous basis, the Program will become an increasingly rich repository of information.

Implementation

The development and installation of the Heritage Program proceeded on an organized schedule. Section three, Description of Methodology, contains a detailed discussion of the planning and organization of the Program. However, the following is an overview of the steps involved in implementing the Program.

- Step 1 - Hire and Train Staff: The Program Coordinator was selected through joint approval of the Division of State Parks and Recreation and The Nature Conservancy. The Conservancy provided a training program, which included the development of schedules for implementation of the contract through the 12-month period. Additional staff were later hired and trained.
- Step 2 - Establish Operations Center: The Department of Natural and Economic Resources assisted in the location of an office for the Heritage Program and furnished necessary furniture, equipment, and materials.

- Step 3 - Generate Classification System: The classification system was developed to identify and define those elements of diversity which were of importance to the inventory process. Knowledgeable experts were consulted and their recommendations resulted in the development of a dynamic classification system.
- Step 4 - Install the Data Management System: The manual, map, and computer files necessary for storing, retrieving, and manipulating data were installed.
- Step 5 - Implement Pilot Program: The collection, encoding, storage, retrieval, and application of information were initiated and continued.

Once the Heritage Program had been installed, the major task was to assemble the data base using information from reliable sources. As the information from scientists, naturalists, other professionals, and published and unpublished sources was incorporated, better decisions regarding the preservation of natural areas could be reached because the data needed were available.

Contract:

The Department of Natural and Economic Resources acting through the Division of Parks and Recreation, the Federal Bureau of Outdoor Recreation, and The Nature Conservancy jointly funded the Natural Heritage Program. The budget for the initial 12-month program was \$120,000. The Mary Reynolds Babcock Foundation provided a grant of \$45,000 and the Z. Smith Reynolds Foundation donated an additional \$15,000. The remaining \$60,000 has been supplied on a one-to-one matching basis by the state from its Federal Bureau of Outdoor Recreation allocation.

Staffing:

The Natural Heritage Program has been staffed by three Conservancy employees and one Division of Parks and Recreation employee. Six additional, part-time research aides were hired from contract monies. The positions and duties of the staff have been as follows:

1. Program Coordinator - Directs and is responsible for all in-state aspects of installing and maintaining the Natural Heritage Program.
2. Research Specialist - Responsible for the Program interests relative to botanical research and information services.

3. Research Specialist - Responsible for the Program interests relative to zoological research and information services, and for assistance to the Coordinator in natural areas protection and management recommendations.
4. Secretary-Data Processor - Responsible for clerical and routine administrative tasks, performs data management functions, performs data input/retrieval for computer operations.
5. Research Aides - Provide assistance where most needed in data collection and encoding.

Computer Facilities:

The Heritage Program uses the state's Administration Computer Center for electronic file needs. The Department of Transportation's plotter is used for computer mapping functions. All computer costs were paid from contract monies.

Other Support:

The Division of Parks and Recreation provided other logistical and technical support where needed.

Applications

The practical value of the information yielded by the North Carolina Natural Heritage Program is severalfold. Using the collected data as an index of relative rarity, the most endangered natural element types can be determined and protection mechanisms employed. The natural diversity inventory enables identification of the state's most significant natural areas, which deserve protective attention.

The Nature Conservancy determines its protection priorities in North Carolina on the basis of evaluations made by the State Natural Heritage Program.

In addition, information made accessible by the Heritage Program can be utilized by various agencies and individuals to plan for minimal ecological damage from development and land use. Heritage information can be used in environmental impact assessments, in resource planning, and in development planning. Decision-makers can be made aware of the effects of alternative courses of action before they are committed to one plan, thus avoiding the conflicts which can arise when evidence of ecological destruction emerges after decisions are made and investments committed. In its initial year, the Natural Heritage Program has gathered extensive information about critical species habitats and other natural elements in the state, and numerous agencies and qualified individuals have begun to make use of the data base as a source of information. (See Section five, Program Progress and Results, for a detailed discussion of program applications.)

Description of Methodology



Description of Methods



DESCRIPTION OF METHODOLOGY

Program Establishment

The State of North Carolina and The Nature Conservancy formalized their agreement to develop the North Carolina Natural Heritage Program in April 1976. The Program began in June 1976 with the hiring and training of a state coordinator and a support staff shortly thereafter.

In August, the Heritage Program's operation center -- the base of program activities, including office space, equipment, and personnel -- was provided. Once the operations center was secured and staffed, the task of generating the working classification of elements of natural diversity was undertaken.

Program Organization

The Heritage process consisted of three major phases in its first year, each phase subdivided into a series of tasks. The first phase, program development, was accomplished when the staff was trained, work plan formulated, data management system established, and the classification system generated. The second phase, the pilot inventory, was initiated as the Program began data collection and processing, and data analysis. The third phase, protection planning, is presented in section six.

Classification System:

The classification system is the cornerstone of the inventory process, its purpose being the identification, definition, and cataloguing by type of the elements of natural diversity in North Carolina. Only those species and features listed in the classification system have been considered elements for the purposes of the Heritage inventory.

Prior to the data gathering phase of the Program, a classification system was developed to document and describe elements of diversity in North Carolina. The system for the pilot inventory contained five classes: Special Animals, Special Plants, Plant Communities, Physical Features, and other Special Habitats. As the Program matures, the working classification can be modified to accommodate needs.

The Special Animal and Plant classes consist of those species and subspecies considered to be of endangered, threatened, special concern, or undetermined status within the state. The classification was adopted from the 1975 Symposium on Endangered and Threatened Biota of North Carolina, sponsored by the State Museum of Natural History. These status categories were defined by the Symposium:

Endangered -- a species whose continued existence as part of the state biota is clearly and imminently at hazard; a species in danger of extinction or extirpation.

Threatened -- a species likely to become endangered within the foreseeable future if certain conditions are not met; a species which exhibits a considerable decrease in numbers beyond the limit of normal fluctuation, or documented range contraction, but which is not yet considered endangered.

Of Special Concern -- a species which exists in small populations (is rare) over a relatively broad range; is targeted for exploitation which could become extensive enough to pose a threat; which because of certain characteristics or requirements is especially vulnerable to specific pressures; or which is so designated for other reasons by experienced investigators.

Undetermined -- a species for which insufficient data exist for precise assessment.

Documentation for the classification system records pertinent information regarding each element, including species description, range, mode of life, status, and sources of information.

The Plant Communities class consists of a classification of the potential vegetation associations, which has been developed largely by Dr. A. E. Radford, UNC-CH. Plant community types distinguish the dominants in the canopy layer and the species in the lower vegetation layers (subcanopy, shrub, herb). The Heritage Program adopted the classification system for use, after endorsement by a task force committee of North Carolina botanists.

The Physical Features class lists various geologic, physiographic, and aquatic features for which unique, unusual, or representative examples may be found. The classification system was composed in consultation with state geologists.

The Special Habitat class is reserved for locations of significant rookeries, colonial nesting and breeding sites, migratory routes, and feeding areas.

A wealth of authoritative sources were drawn upon to formulate the working classification system. Knowledgeable biologists and geologists within the state made valuable contributions to the classification system and later to the pilot inventory. These scientists gave freely of their knowledge and time in offering constructive criticism and suggestions, and enabled the Heritage staff to build a broad-based working classification system.

Primary emphasis has been placed on the Special Animal and Plant Species classes due to the vulnerability of these elements. A major portion of the data gathering time has been devoted to these elements.

We found that vegetational research done in the past seldom has been detailed enough to fit the Plant Communities classification system.

Classifications for elements of natural diversity inventoried by the Program in our pilot year are given in the appendix of this report.

Data Management System:

The Heritage Program is a comprehensive attempt to determine the state's most significant natural areas, through an intensive statewide inventory. The Program's approach to gathering data is based on the premise that reliable, predetermined sources should be consulted first for information leads. The people, agencies, publications, and unpublished sources within an area of interest were identified and considered for their potential value. A list of sources was assembled in a Resource Catalog. The collected information on elements of natural diversity is stored in manual and computerized files, including the Topographic Quadrangle Map File, Geographic Manual File, Element Manual File, Managed Area File, and LCD (Computer) File.

Resource Catalog:

The Resource Data Sheet is a reference instrument which serves as a bibliography of pertinent sources of information. The Resource Data Sheets cite scientific authorities, documents, and other studies, and are filed by element type (e.g. mollusks or ferns) and subdivided by region of the state (mountains, piedmont, coast, or statewide). The Resource Data Sheets are maintained in the operations center's Resource Catalog files. A sample sheet is shown (figure 1).

The catalog provides a rapid access method to all known individuals, agencies, and literature. It is continually updated and modified.

Index Code:

The element Index Code is the key which unlocks the doors of the data storage system. The Index Code explains the organization of data in the Geographic Manual File, Element Manual File, and Topographic Map File.

Each element occurrence has its own number. The element's Index Code enables retrieval of all data stored in the manual and computer files that relate to the element.

The Index Code is comprised of four sections. Section one identifies the element by noting the alphabetic class code and the numeric subclass and element codes, as defined in the classification system. The second section uniquely identifies each particular occurrence of the element. The third section is the universal map code number, which indicates in which topographic quad map the element can be found. The fourth section,

Element	Region	P	I	A
BIRDS	COAST		X	

RESOURCE DATA SHEET

Element Birds

Region N. C.

C
O
N
T
A
C
T
S

Name of individual/organization _____

Address and phone no. _____

Background information/notes _____

D
O
C
U
M
E
N
T
S

Name of Document Ecological Succession of Breeding Birds in Relation to Plant Succession on Dredge Islands in North Carolina. Estuaries.

Name of author/editor Soots, R. F. and J. F. Parnell

Publisher: Name, date, location UNC-SG-75-27 December 1975
Sea Grant Program. 1235 Burlington Laboratories, N. C. State
University, Raleigh, North Carolina 27607.

Background information/notes _____

Material Location _____

Information Utilized _____

Copy in hand Yes

Copy ordered _____ Date _____

the destruction code, informs the user if the element at that particular location has been destroyed or is threatened with destruction (see figure 2).

A complete description of the structure of the Index Code is found in the Operations Handbook maintained at the Operations Center.

Topographic Quadrangle Map File:

All data that can be plotted on maps, such as location of the element, its range, and information on natural or political boundaries, have been recorded on 7.5 minute topographic quadrangle maps distributed by the U.S. Geological Survey. The quad maps were identified using the Universal Map Code Locator System numbers; the U.M.C. uses a geodetic cell hierarchy to locate an area of interest at increasing levels of resolution (figure 3). The highest level of resolution is the topographic quad map. The topographic quad maps are supplemented by 7.5 minute orthoairal photo maps.

These quad maps are identified by a seven-digit code number made up of a two-digit latitude number giving the degrees north latitude; a three-digit longitude number giving the degrees west longitude and a two-digit quadrangle number. The quad number identifies the 64 7.5 minute maps found in an area bounded by whole degree lines of latitude and longitude. The first of the two quadrangle digits indicated the proper row in the matrix whereas the second digit represents the proper column.

An example of the complete seven-digit quadrangle code for the Wake Forest, N.C. quadrangle would be: 35 078 85. In this example, the Wake Forest quadrangle would be at row 8 column 5 of the eight-by-eight matrix encompassed by the 35° N latitude and the 78° W longitude. Because latitude is determined from south to north and longitude from east to west, the row-column numbers begin in the southeasternmost corner of the matrix.

Element occurrences are recorded on the topographic quad maps, as illustrated in figure 4.

Geographic Manual File:

Data stored in the Geographic Manual File (GMF) are geographically referenced. All information about the occurrence of a special element, whether generated from secondary sources (published literature), or field surveys, is placed in the SMF.

Data stored in the GMF are organized first into files which coincide with topographic maps, with one folder for each of the USGS 7.5 minute topo quad maps located within the state. Each file in the GMF is labeled with the Universal Map Code Locator System number for the topo map it represents. Each topo file contains information on all the element occurrences located in that quad.

CLASS SUBCLASS ELEMENT OCCURRENCE NO. QUAD CODE DESTRUCTION CODE

SP . 14 . 087 . 001 . 35 083 36 . ———

SPECIAL PLANT

ENDANGERED ENDEMIC
VASCULAR

BUCKLEYA DISTICHOPHYLLA

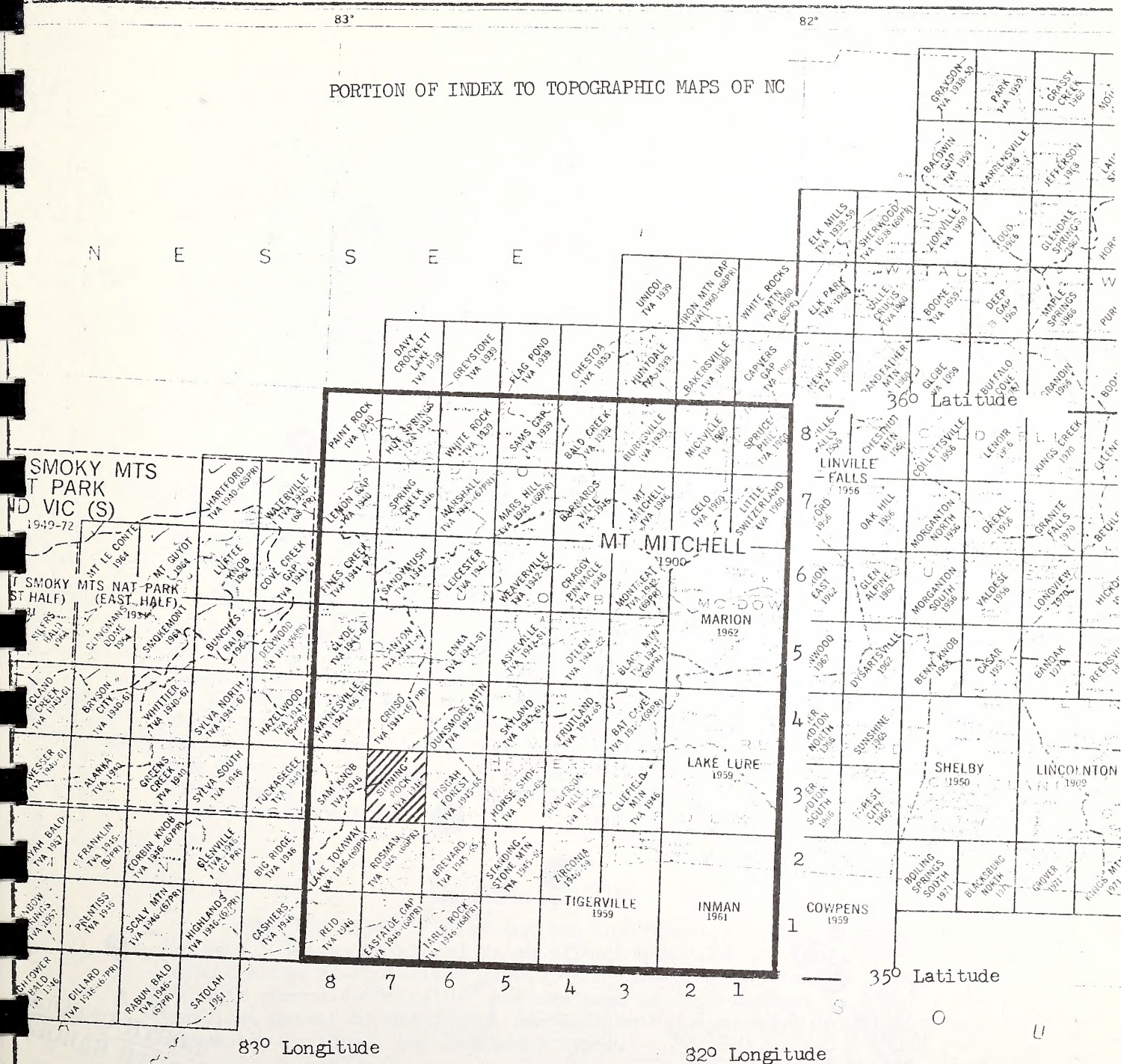
FIRST ELEMENT OCCURRENCE

DEGREES LATITUDE
DEGREES LONGITUDE

QUAD ROW
QUAD COLUMN

figure 2

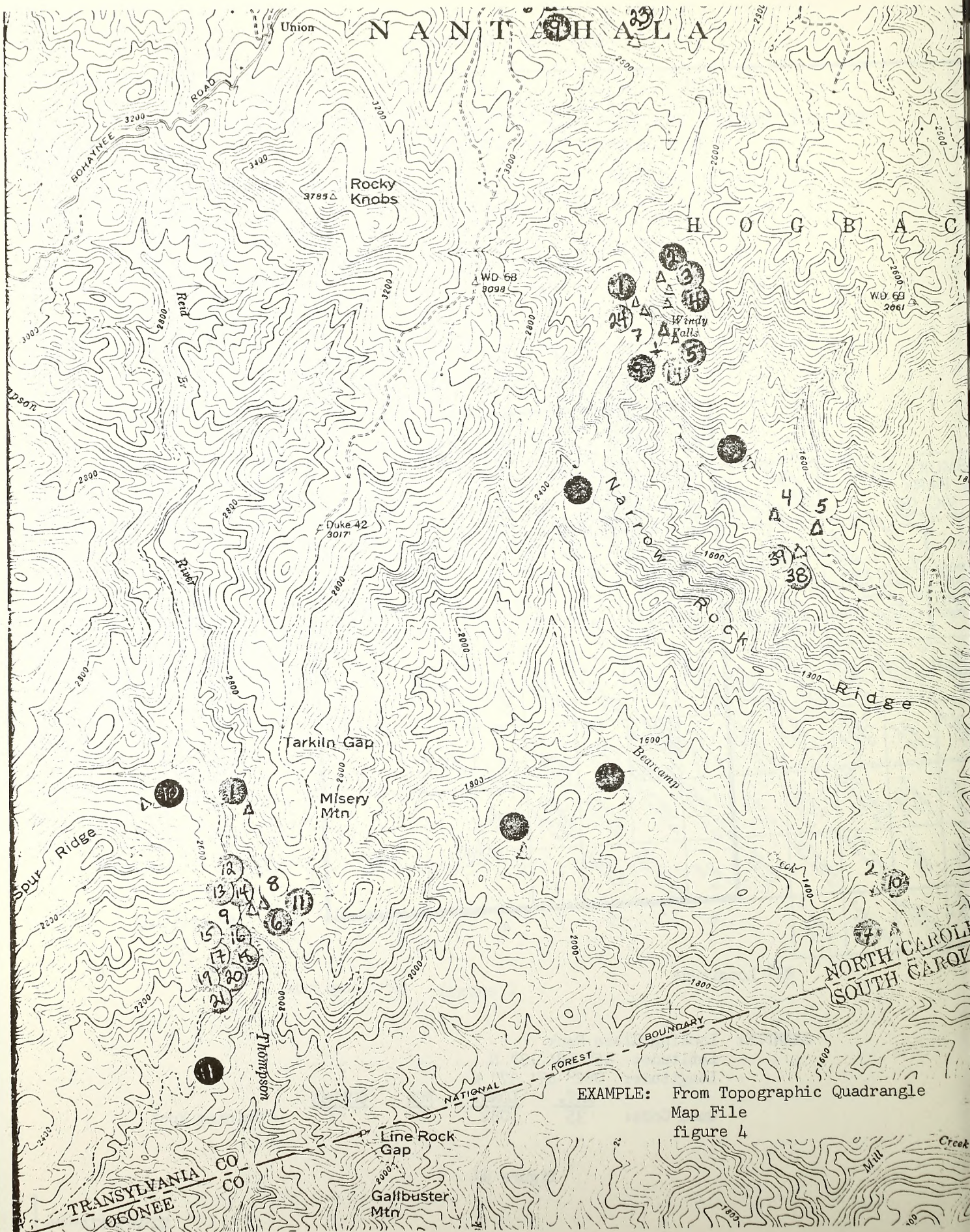
QUAD CODE ILLUSTRATION



EXAMPLE: Looking Glass Rock
 Latitude: 35° 18' 13" N
 Longitude: 082° 47' 37" W

QUAD CODE	LAT.	LONG.	ROW	COLUMN	FEATURE
35	082	3	7	=	Shining Rock

figure 3



EXAMPLE: From Topographic Quadrangle
Map File
figure 4

Element Manual File:

The Element Manual File contains general information applicable to each element, such as range information, ecology of the element (e.g. life histories), and additional references. The Element Manual File serves as a backup to the Geographic Manual File. Any general element data which does not describe an element at a specific location is filed in the Element Manual File. Copies of element occurrence reports are filed in the Element Manual File.

Data stored in the Element Manual File is organized using element Index Codes. Each element has its own file, labeled with the element's Index Code and name. The file is stored in the Element Manual File in alphanumeric order, using the class letters and subclass and element numbers.

Managed Area File:

The Managed Area File contains all information specific to the area, including special maps, aerial photographs, master plans, etc. The information is filed by bureau, service or other sub-agency; then by designated program; then by name of area, alphabetically. Information about private land preserves also is collected in the Managed Area File.

Maintenance of information on managed areas is important for three reasons: First, existing, well-protected managed areas represent the only reliable reservoir for the perpetuation of diversity. Second, those elements of diversity which occur on less protected managed areas should be the easiest to further protect through approaches which will typically require no change of ownership rights or legislative action. Third, managed areas are often a rich source of leads on element occurrences and other data because of the presence and interest of managers who may have a good deal of information on the area and the ability and willingness to collect more.

LCD Computer File:

The LCD Element File--and its instrument, the LCD Element Form (figure 5)--was developed as an effective methodology for the electronic manipulation of ecological data. "LCD" was derived from the phrase "lowest common denominator" and was used in this context to specify the smallest amount of meaningful correlative data recorded for significant elements, features, and landscape types.

By using the computerized data base approach, several advantages may be realized. First, the information is not outdated at the instant it is published, since the computer file can be repeatedly updated. Second, research time can be reduced considerably by allowing a user to quickly obtain information specific to his geographic or subject area of interest. Third, spatial information can best be visualized, interpreted and displayed by maps; for this reason, the computer system will also provide maps displaying information contained in specific data

* * * REINPUT

LCD ELEMENT FORM

CARD 1

NAME OF ELEMENT

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
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CARD 2

LATITUDE & LONGITUDE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
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STATE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
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COUNTY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
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USGS QUAD NAME

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
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subclass

occurrence

destruction

R - reported

C - confirmed

T - threatened

CLASS

element

INDEX CODE

QUAD CODE

49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69

CARD 3

SOURCE OF LEAD

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
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CARD 4

DATE OF INFORMATION

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CARD 5

OWNERS

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PROTECTION STATUS

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SPECIAL STATUS

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CARD 6 - 8

GENERAL DESCRIPTION

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CARD 10

CONTENTS OF MANUAL FILE

DIRECTIONS

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BOUNDARIES

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PHOTOS

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FIELD SURVEY

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OWNER INFORMATION

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
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CODE

D

B

P/A/B

E/V/B/S

O

R

V/U

C/U/N

categories in addition to the traditional textual printouts. Maps may be obtained either on standard plotter paper or on mylar, which can be overlaid on a data-rich base map. This permits a concise graphic representation of information as well as a means of assembling eco-geographical data.

With a computerized data base, it is possible to quickly determine which areas share common characteristics, such as lands owned by federal agencies. The system is also an invaluable aid in setting priorities for land acquisition or other protection strategies. The LCD provides an index of relative rarity by showing which elements, types or features have few or no reported occurrences. This measure of the rarity of data types becomes more accurate as the system gains data. When the collection of ecological data becomes optimally enriched, the search and permutational capability inherently offered by the computer program will allow users to efficiently analyze, cross-reference, compare and inter-relate data.

A complete discussion of the LCD computer file can be found in the user's manual, the Lowest Common Denominator Element File, maintained at the Operations Center. The search capabilities of the computer system are virtually unlimited (figure 6). Sample printouts (figure 7) and an example of selectively retrieved data (figure 8) follow.

figure 6

List of Searchable Fields

<u>FIELD NAME USED IN SEARCH REQUEST</u>	<u>TRANSCRIPTION FORM TITLE</u>
CLASS	Class code
COUNTY	County Code
DESTRUCT	Destruction code
EL_CODE	Element code
LOC_VERIFIED	Coordinates code
* NAME	Name of Element , occurrence number
NAME_OWNER	Name of Principal Owner
NUM_OWNERS	Owners (number of)
QUAD_CODE	Quad Code
QUAD_NAME	USGS Quad Name
PROT_STATUS	Protection Status code
SITE_NAME	Name of Area
SIZE	Size (Acres)
** SPECIAL_STATUS	Special Status
SUBCLASS	Subclass code
YEAR	Date of Information (year)
YEARMONTH	Date of Information (year & month)

* Note that you may search by some portion of the NAME field (e.g., name of genus) or by the entire field. To select individual records you can search by name and occurrence

** You may search by part or all of the special status field.

*** You may search by codes within the general description.

**** You may search by name or word within the information lead field and general description.

INDEX KEY SP_WOLFFIA_COLUMBIANA_001 (V)

STATE NC

COUNTY 055

INDEX CODE 24.757.001.3507586

NAME OF SITE/AREA NAGS HEAD WOODS

NUMBER OF OWNERS ON

PRINCIPAL OWNER

SOURCE OF LEAD

GENERAL DESCRIPTION

COORDINATES 355930N0753950W (N)

USGS QUAD MAP NAME MANTED

SPECIAL STATUS

PROTECTION STATUS 3

DATE OF INFORMATION 197307

SIZE

LEITH, H.-EVALUATION OF NAGS HEAD WOODS-MA FILE

COMMON WATER-MEAL. IN FRESHWATER PONDS IN NAGS HEAD WOODS.

CONTENTS OF MANUAL FILE DIRECTIONS BOUNDARY ON TOPO PHOTOS FIELD SURVEY OWNER INFO REFERENCES

INDEX KEY SP_WOLFFIA_COLUMBIANA_002 IV)

STATE NC

COUNTY 073

INDEX CODE 24.757.002.3607635

NAME OF SITE/AREA MERCHANTS MILLPOND STATE PARK

NUMBER OF OWNERS 01

PRINCIPAL OWNER NC ONEP SP

SOURCE OF LEAD STUDY OF MERCHANTS MILLPOND-EAKES, TAYLOR, ETC.

GENERAL DESCRIPTION COMMON WATER-MEAL. MERCHANTS MILLPOND.

COORDINATES 362530N0764100W (N)

USGS QUAD MAP NAME BECKFORD

SPECIAL STATUS

PROTECTION STATUS 3

DATE OF INFORMATION 197208

SIZE

CONTENTS OF MANUAL FILE DIRECTIONS BOUNDARY ON TOPO PHOTOS FIELD SURVEY OWNER INFO REFERENCES

INDEX KEY SP_WOLFFIA_PAPULIFERA_001 IV)

STATE NC

COUNTY 055

INDEX CODE 24.758.001.3507586

NAME OF SITE/AREA NAGS HEAD WOODS

NUMBER OF OWNERS ON

PRINCIPAL OWNER

SOURCE OF LEAD

GENERAL DESCRIPTION

COORDINATES 355930N0753950W (N)

USGS QUAD MAP NAME MANTED

SPECIAL STATUS

PROTECTION STATUS 3

DATE OF INFORMATION 197307

SIZE

LEITH, H.-EVALUATION OF NAGS HEAD WOODS-MA FILE

PAPILLOSE WATER-MEAL. IN FRESHWATER PONDS IN NAGS HEAD WOODS.

CONTENTS OF MANUAL FILE DIRECTIONS BOUNDARY ON TOPO PHOTOS FIELD SURVEY OWNER INFO REFERENCES

SAMPLE PRINTOUT

figure 7

* SA_Pelecanus_occidentalis	1

SA_Percina_aurantiaca	6

SA_Percina_burtoni	3
**	
SA_Percina_caprodes	2
**	
SA_Percina_macropcephala	2
**	
SA_Percina_maculata	2
**	
SA_Percina_sclera	2
**	
SA_Percina_squamata	2
*	
SA_Phenacobius_teretulus	1
*	
SA_Pimephales_notatus	1

SA_Plecotus_rafinesquii_macrotis	15
*	
SA_Plethodon_dorsalis_dorsalis	1
**	
SA_Plethodon_longicrus	2

SAMPLE FREQUENCY

figure 8

Program Implementation

Data Collection and Processing:

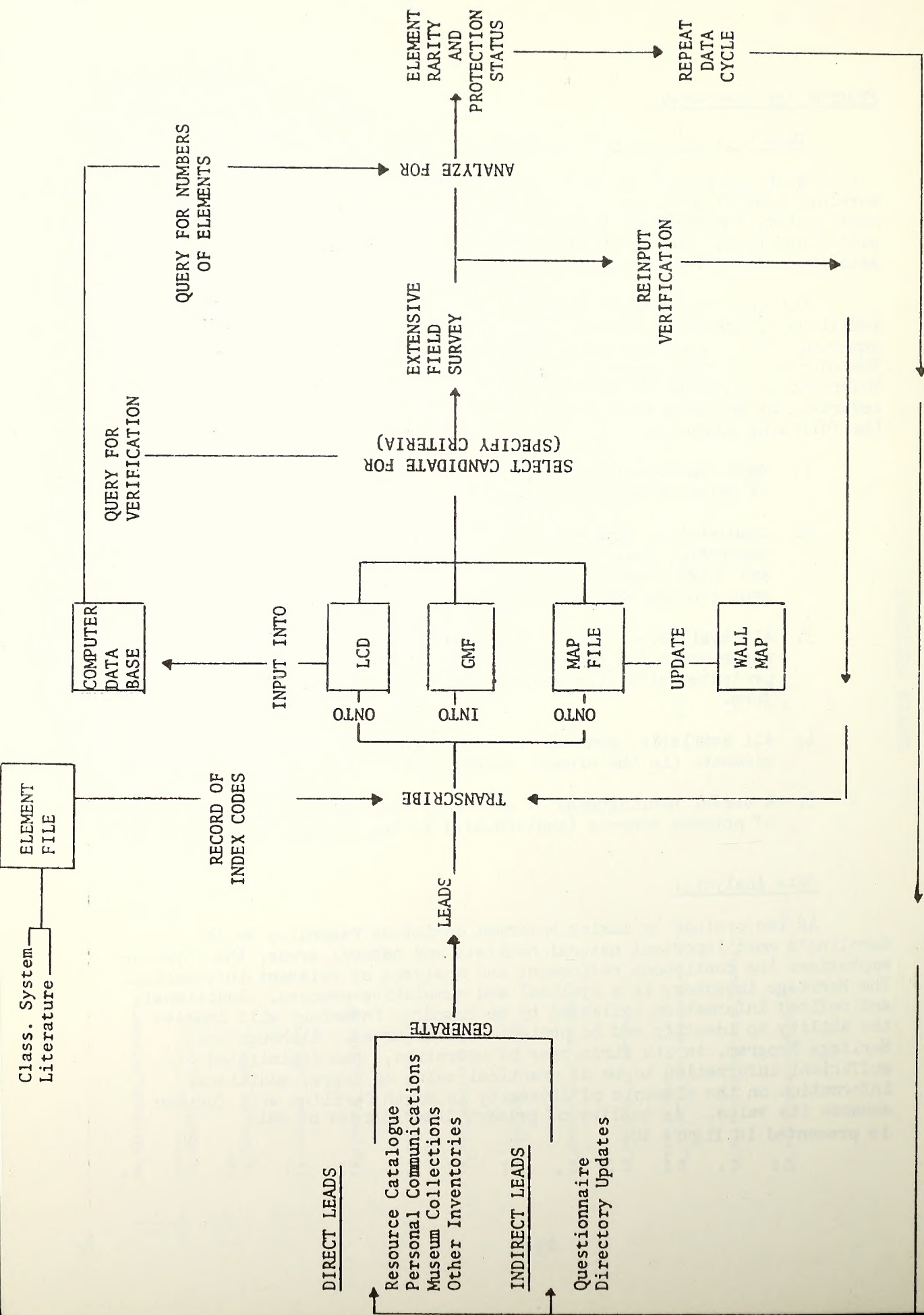
With the establishment of program operations, generation of a working classification system, and the development of the data management system, the Heritage Program commenced its second phase: the pilot inventory. The pilot inventory consisted of data collection, data processing, and data analysis tasks (charted in figure 9).

Data collection began with a strategy of first consulting individuals, agencies, museums, publications, and unpublished materials expected to provide the greatest amounts of reliable information. The sources are catalogued in the Resource File, and element occurrence information is placed in the filing system following appropriate procedures. By applying this methodology, the Heritage Program created the following products:

1. Maps depicting plotted locations of all reported occurrences of selected natural elements (in quad map file).
2. Standardized information on these occurrences, their location, ownership, protection and management status, source of lead, and field studies; and a clear identification of certain data gaps (in the computer file).
3. All available items of additional information on the element occurrences (in geographic manual file) and on presently protected sites (in managed areas file) organized in retrievable form.
4. All available, general information on individual natural elements (in the element manual file).
5. A useful bibliography of secondary sources and a directory of primary sources (individuals) in the resource catalog.

Data Analysis:

As the prelude to making informed decisions regarding North Carolina's most important natural habitats and natural areas, the inventory emphasizes the continuous refinement and analysis of relevant information. The Heritage inventory is a cyclical and cumulative process. Additional and refined information collected by an ongoing inventory will improve the ability to identify and to protect natural areas. Although the Heritage Program, in its first year of operation, has assimilated sufficient information to be of practical value to users, additional information on the elements of diversity in North Carolina will further enhance its value. An outline of primary lead sources of data is presented in figure 10.



INVENTORY METHODOLOGY
figure 9

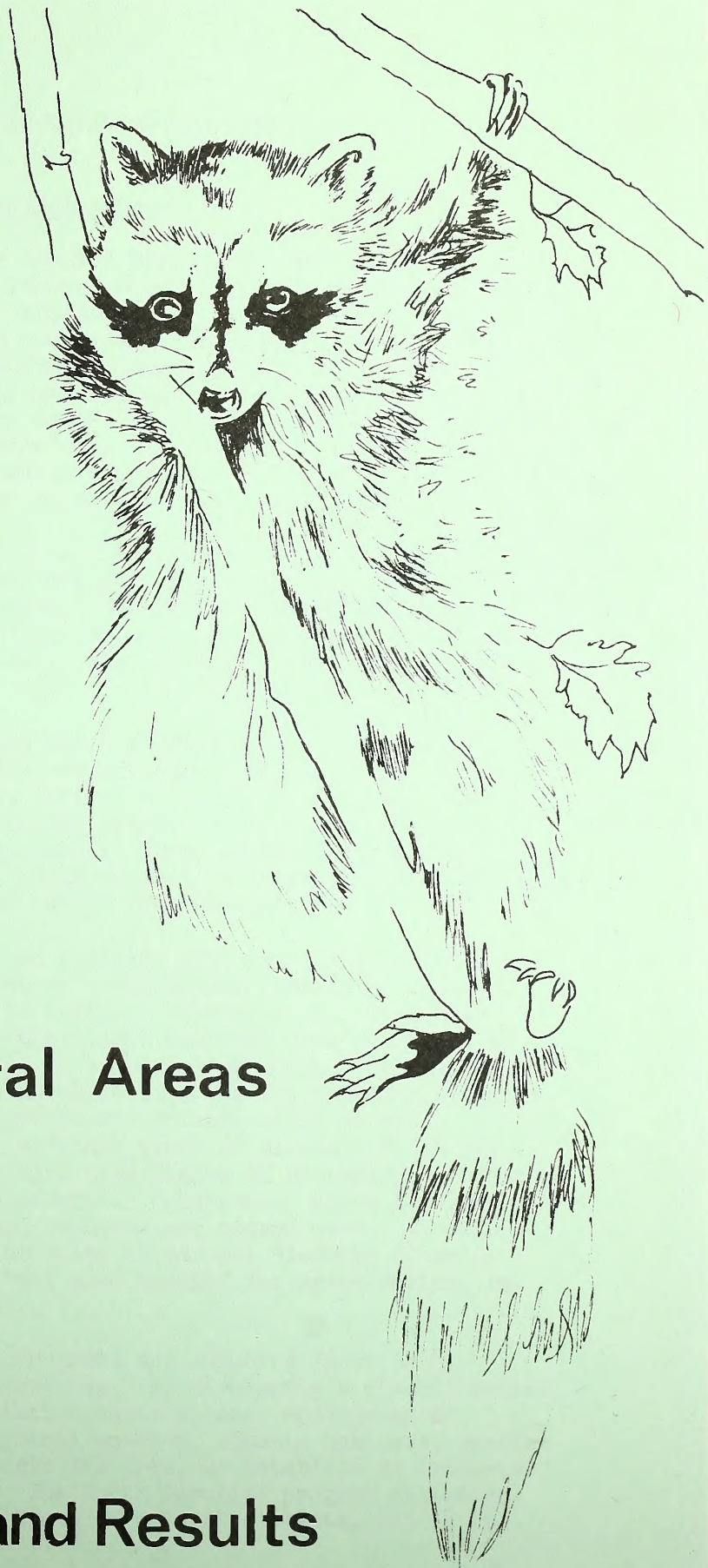
DIRECT LEAD SOURCES

	Special Animals	Special Plants	Special Habitats	Plant Communities	Physical Features	Aquatic Features
Potential National Natural Landmarks theme studies	+	+	+	+	+	+
State Parks Natural areas studies	+	+	+	+	+	+
Parks and Recreation master plans	+	+	+	+	+	+
State Museum Nat. Hist. collections	+	-	+	-	-	-
Highlands Biological Station	+	+	+	+	-	-
Wildlife Resources Commission	/		/			
Coastal Resources Commission						
Corps of Engs. envir. reconnaissance	+	+	+	+	+	+
NPS, FWS, FS data collections	/	/	/	/	/	/
University herbariums, museums	+	/	NA	NA	NA	NA
SCS county inventories						
Research institutes						
Environmental impact statements						
Theses, dissertations	/	/	/	/	/	/
Regional planning studies						
Land resource managers, naturalists	/	/	/	/	/	/
Journal articles						

- + pilot review completed
- no information available
- / research in progress

Field Surveys:

An analysis of the data base allows the Heritage staff to identify gaps in information so that efforts can be concentrated on data voids and weaknesses. Extensive field surveys by the Heritage staff or by others will verify and clarify element occurrence reports. Intensive field surveys provide more detailed element occurrence and location data. The Heritage Program, even in its first year, has undertaken some extensive and intensive field surveys (e.g. Rocky River Bluffs, Boyd Estate, Panthers Den, Nags Head Woods, Currituck Banks, Bluff Mountain, Stone Mountain). These field evaluations have been initiated for natural areas identified in the pilot inventory as significant and of special concern due to current protection efforts or management issues. In most cases, the Heritage Program acts as a clearinghouse for the field investigations of others.



Identification of Significant Natural Areas

Program Progress and Results

Program Progress and Results

Identification of Significant Natural Areas

The following table lists the significant natural areas identified during the program. The areas are categorized by their location and the type of natural resource they contain. The table includes the name of the area, its location, and a brief description of its significance.

Area Name	Location	Significance
1. [Illegible]	[Illegible]	[Illegible]
2. [Illegible]	[Illegible]	[Illegible]
3. [Illegible]	[Illegible]	[Illegible]
4. [Illegible]	[Illegible]	[Illegible]
5. [Illegible]	[Illegible]	[Illegible]
6. [Illegible]	[Illegible]	[Illegible]
7. [Illegible]	[Illegible]	[Illegible]
8. [Illegible]	[Illegible]	[Illegible]
9. [Illegible]	[Illegible]	[Illegible]
10. [Illegible]	[Illegible]	[Illegible]

IDENTIFICATION OF SIGNIFICANT NATURAL AREAS

Approach of inventory and information system

The principal goal of the Natural Heritage Program is to identify and to protect North Carolina's natural diversity. The mission of the North Carolina Natural Heritage Program is to conserve the state's natural diversity by finding and protecting rare and threatened species habitats and other significant natural features. The reasons for preserving natural diversity are complex but are based on four premises: diversity promotes the stability of ecosystems, diversity increases the possibility of future benefits to be derived from nature, diversity is a source of human satisfaction, and protecting diversity is an ethical necessity (see next section of this chapter).

The objective of protecting natural diversity first requires identifying what species, natural features and ecosystems are rarest, most endangered, and least protected. These three considerations — rarity, endangerment, and protection status — are the heart of our criteria for identifying significant natural areas and for establishing protection priorities.

A major shortcoming of most past inventories has been the limitation imposed by their site-by-site methodology. Each site, or section of the real landscape, is unique, either in regard to unduplicated characteristics or the combination and spatial distribution of its habitats, species, and other components. Thus, attempts to directly compare sites inherently partake of an attempt to compare unlike entities, not only "apples to oranges," but "whole fruit baskets."

In an attempt to resolve the problem, many inventory projects have relied on less than satisfactory quantitative evaluation systems. Frequently, the result has been to submerge consideration of natural diversity while allowing broadly applicable measures such as degree of threat, size, or even "prettiness" to assume overwhelming importance. This often leads to the syndrome in which some habitat types or elements are preserved redundantly while others are not preserved at all. Limited examples of ecosystems, landscape types or elements which are well represented in areas retaining a high degree of naturalness become frequent objects of preservation efforts. Conversely, types or elements which remain as only a few damaged remnants are passed over. It might seem absurd that the last, best examples of natural elements close to extinction could be rejected as "not good enough" for preservation, but this is exactly what can happen.

To correct this, Heritage Programs are focusing first on the elements of natural diversity themselves. By developing a classification of element types, including vegetation associations, endangered or otherwise significant plant and animal species, aquatic habitats, special animal habitats, and unique geologic features, we establish an extensive list of preservation objectives. The North Carolina program assembles occurrence information for these types of natural elements, but in its

pilot inventory has concentrated on endangered and threatened species habitats. We reject the notion that an inventory program can limit itself solely to vegetation communities and expect that other natural elements will somehow take care of themselves. The element list can be expanded by addition or subdivision of elements or by incorporating whole new classes of elements. By dividing natural area sites into their components it is possible to create element files. Within the natural element files, we can collect and compare reported occurrences of a particular type (e.g. Atlantic white cedar or red-cockaded woodpeckers).

The element file structure provides an index of relative rarity by showing which elements have few or no reported occurrences. The index becomes more accurate as the system gains data. The files promote efficient data accumulation since the compilation of similar types assists specialists in concentrating and targeting their field survey activities. Most importantly, direct comparisons can be made on the basis of real data (as opposed to subjective judgment). The comparison of element files gives us an opportunity to look at selected aspects of the total area and to examine the occurrence of a single element. The questions of relative significance and criticality can then be rigorously addressed.

However, site-specific questions referred to before are also important. In judging the qualities of an ensemble—a number of co-located elements—a chronic difficulty has been setting boundary lines to delineate exactly what a "site" is. In setting out to survey or preserve an endangered bog-inhabiting plant, for example, one concludes that its preservation will depend on the protection of its habitat, the bog itself. The bog, in turn, is found to be a part of a pond system, whose integrity depends upon the protection of its shoreline and the quality of its tributaries. Protection of the tributaries involves the adequate protection of the entire watershed. The shoreline is found to contain a good example of a particular forest-type. The forest stand, in turn, is inhabited by a certain animal species. The species has a large home range and depends upon the maintenance of a minimum breeding population with even larger range requirements. Collectively, the bog, the ponds, the forests, the wildlife are all linked to other natural elements which are part of still larger systems. Thus, by attempting to trace the limits of an ecological boundary, we see that the environment of the original target element can encompass the entire world.

Establishing boundaries and delineating sites are complex tasks. It is necessary to make some trade-offs. The legal boundaries of already protected sites provide a set of useful conventions. By compiling information on the natural elements contained on the sites and cross-referencing to the element files, we can analyze how thoroughly element types are represented within the current system of protected land.

The same boundary approach is also useful in establishing perimeters for prospective preserves. The lines may be drawn to collect a diversity of elements and to arrange for optimum viability, defensibility, manageability, interdependency, and utility of the various

components. Remaining element occurrences, not readily assignable to particular sites, are plotted on base maps. From the base maps we can identify collections of high priority elements to define desirable ensembles.

The more information contained in the plotting data, the more quickly we can see the ecological circumstances under which these ensembles exist. The quality of ensembles can then be evaluated by determining the diversity and the relative quality of elements located in proximity to one another.

We feel that keying the inventory process to elements of natural diversity is the best approach so far advanced for identifying preservation priorities.*

*This discussion is largely excerpted from Robert E. Jenkins, "Heritage Programs: Inventory Progress Report," Ecology Forum No. 15, TNC News.

Why Save Diversity?

by G. Jon Roush

The mission of The Nature Conservancy is to protect America's natural diversity by finding and protecting rare and threatened habitats, natural areas, and natural features. Why is it important to do so? What difference does it really make if we hasten the processes of extinction and lose some species of clam, or if we plow the last remaining example of a kind of prairie?

The reasons for protecting natural diversity are complex, and not everyone agrees in each instance, but everyone should be able to agree on four basic premises, any one of which makes the preservation of natural diversity an imperative of the most serious order. The four premises are these: diversity promotes the stability of ecosystems, diversity increases the possibility of future benefits, diversity is a source of human delight, and protecting diversity is an ethical necessity.

Diversity and Stability

What's the use of alligators? For ages, alligators have snoozed, bred, and fed in "gator holes," large depressions scooped out of the ground by the alligator, which fill with water to form permanent

pools. Each of these pools houses its own world of algae, ferns and other plants, fish, and amphibians, some of them nourished by droppings and bits of food left by the alligator. In dry years these gator holes and trails between them form the only sanctuary for many of the Everglades' creatures, which will move out again to repopulate the area when the rains return. Near the gator hole itself, the female alligator makes a large nest of sticks and mud every year; and over the years, these nests can build up to form dry islands, supporting trees that provide nesting places for herons and other birds. Although the gator at the bottom of the tree may eat an occasional chick, it is also an unwitting sentinel, keeping tree-climbing predators away.

When the alligators themselves fell prey to man's whim to have shoes and handbags made from their hides, this ancient arrangement was upset. Gator holes filled in and dried up, no longer serving as centers of life. The area's hydrology suffered, and the whole system was weakened. Meanwhile, fishermen complained that fishing in the Everglades was not what it used to be. Bass and other sport fish were being devoured by spotted gar fish,

whose numbers were increasing every year. What had been keeping the gar in check? Its natural predator, the alligator.

It is the diversity of the Everglades system that holds it together and sustains it through lean years. Remove any element of that diversity, and the system may be weakened. Remove a key element like the alligator, and the system falters disastrously.

A stable ecosystem is one that can withstand changes without going haywire. Diversified ecosystems tend to have many overlapping systems of checks and balances so that the system as a whole is buffered against the impact of any particular change. When American farmers a hundred years ago replaced diverse native prairies with vast monocultures of single species of corn and grain, they helped set the stage for the dust bowl of the 1930's. In parts of the Midwest it was only the remnant areas of diverse natural prairie land that kept any soil intact during that terrible drought.

Indeed, the reduction of diversity is almost always expensive. When we spray a neighborhood for mosquitoes, for example, killing or driving away many of the mosquitoes' natural predators and breeding a race of mosquitoes resistant to the insecticide, we have set ourselves up as the perpetual guardians of that area, responsible for expending our time, money, and ingenuity to keep the mosquitoes down and the system going. We are driven by the well-grounded fear that if we ever let our guard down—now that the natural mosquito controls have been reduced—the mosquitoes will return tenfold and more savage than ever.

But if we are ever to reestablish health in systems that we have impoverished, we will need a reservoir of genetic resources to draw on. Once extinct, a species cannot be re-created. Consequently, The Nature Conservancy devotes much of its effort to protecting species and ecosystems that are rare and endangered. Although an area or endangered species habitat may not be particularly diverse by itself, it protects a part of the future diversity of the planet.

Diversity and Future Benefits

France's finest grapes grow on root stocks imported from America. This root stock produces its own grape that is inferior for eating or wine making, and Americans were in the process of eradicating it when a virulent rust attacked the roots of native vines in Europe. The American stock was found to resist this rust, and so the European vines were grafted onto it, saving the European wine industry.

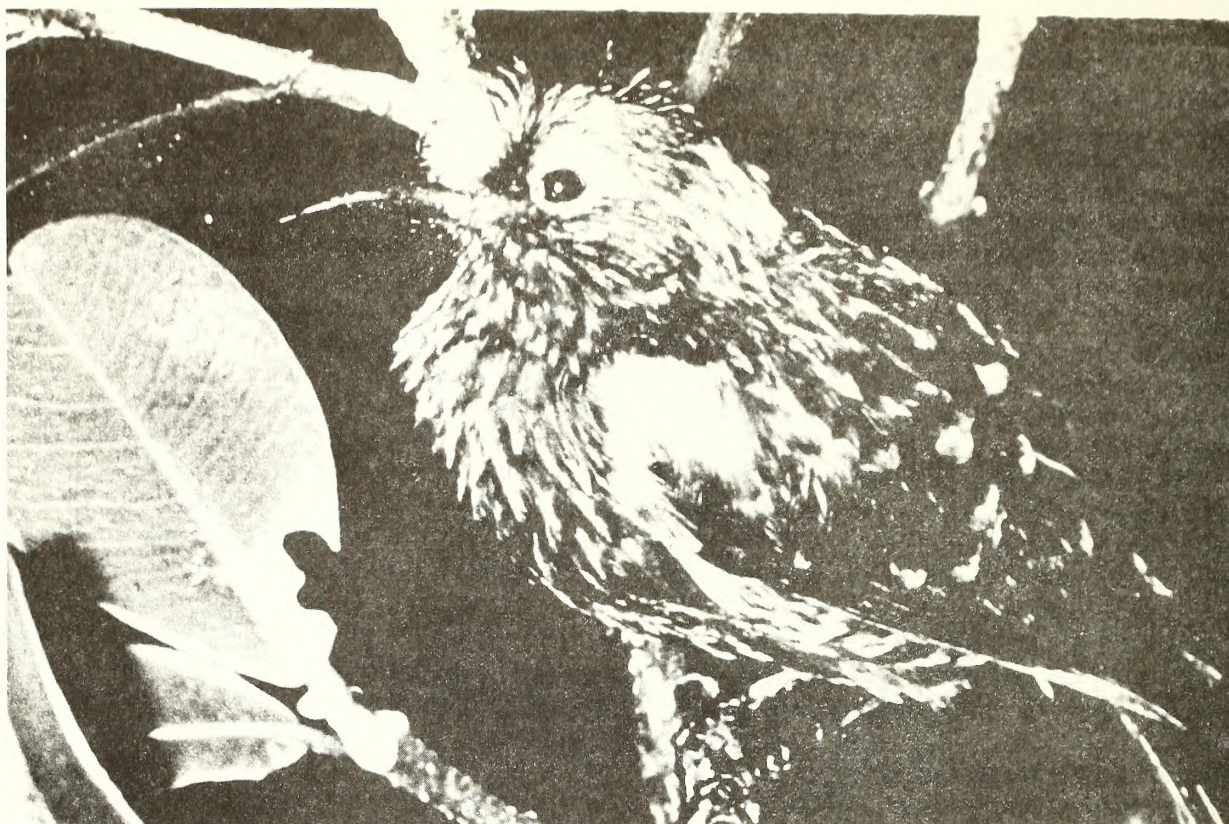
Such ecological rescues are not unusual, nor are the discoveries of totally new possibilities. The potential utility of living species is so great that the U.S. Department of Agriculture has established a separate unit, the Medicinal Plant Resources Laboratory, to identify new, useful plant substances. For example, some species of the Ethiopian plant genus *Maytenus* produce substances called maytensines, which show promise for the treatment of cancer. Unfortunately, the Ethiopian plants produce this substance in such minute quantities that researchers had trouble collecting enough for experimentation. They searched for another species that might produce maytensines in more quantity, and they found it in Kenya, in a rare plant that happened to be protected in a forest preserve. Now the tests could be continued, and they were more promising than ever, but still a more productive source of maytensines had to be found. Once again a forest reserve yielded the right plant, but in South Africa. This time the plant was of the closely related genus *Putterlickia*, again rare but a better producer of maytensines. This species, which the world would never have missed if it had become extinct five years ago, is now a major target for conservation.

Usually the easiest, most efficient, and surest way to conserve a species is to preserve its habitat. In fact, it is most useful to preserve a diverse set of habitats to accommodate variations within species and evolution of new species.

For example, a family of Hawaiian birds known as the Honeycreepers (*Drepanididae*), contained 22 distinct species when Europeans began to settle the islands in the early 19th Century. Some looked like finches, others like woodpeckers, warblers, or parrots. All of these species were apparently descended from one common species, a finch-like bird that arrived in the islands about a million years ago. Each descendant species found its own ecological niche on the islands. Each adapted to a particular habitat with distinct food and territory, permitting all the final species to get the most from the islands with minimal competition among themselves.

Moreover, two or more ecosystems can interact with each other to support diversity, even when they are not physically connected. Studies of islands have shown that the species count on any island is related to its distance from other islands or the mainland. The closer two island ecosystems are to each other, the more the migration of species from one island to the other, the slower the extinction rates, and the greater the diversity.

In fact, natural diversity of any sort tends to further species diversity. Protect a representative array of ecosystems, and you have dramatically



The crested honeycreeper is one of 22 distinct species which evolved from one common species in Hawaii. Due largely to destruction of the native forest and introduction of disease-carrying insects, many of the species are now extinct. The crested honeycreeper is very rare and persists only on the northeast slope of Haleakala volcano on Maui.

improved the chances of all the species that inhabit them. The undeniable yet unpredictable utility of living species is sufficient grounds for mankind's caring about such things, for a species is truly "useless" only when it is extinct.

Diversity and the Quality of Life

It is reasonable to assume that the capacity to enjoy natural diversity is innate in every human being, that indeed every human being has a genuine need for natural diversity, and that to be deprived of that diversity pains even the staunchest lover of cities, consciously or unconsciously.

Early man evolved in a diversified savannah-forest habitat. As many anthropologists have pointed out, the evolution of *Homo sapiens* required the prior appearance of plants that produce seeds, with their concentrated food value to fuel the high metabolism of mammals, especially primates, with energy-consuming brains. Early man, who fed on seed-feeders and eventually learned to cultivate seed-bearing plants himself, was especially fit for and predisposed to live in the diversified environment at the edge between forest and grassland. That predisposition lives on in modern man. When our forefathers, for example, moved west into the American wilderness, they made

clearings in the forest and planted trees on the plains, as if re-creating our original habitat.

In other words, we may have good genetic reasons for liking a field of grasses and wildflowers, for preferring the biologically diversified habitat that nourished and protected us as a species and provided the earliest arena for the exercise of our physical and mental flexibility. Today any natural place that people call beautiful is almost certain to be a diversified, healthy ecosystem, whether it be a marsh, a tallgrass prairie, a desert, or an alpine meadow. Variety *does* seem to be the spice of life.

Probably the more complex human civilization becomes, the more diverse the set of natural resources needed to sustain it. Unfortunately this need is often hidden, because we see only the products manufactured from those resources. Yet even if we could substitute a totally artificial environment for the natural one, something would be missing. What would it be like to adapt totally to the products of other human minds? For most of us it would be a nightmare, because we need to perceive a permanent, autonomous reality of which we are a part. As one of Berthold Brecht's characters put it, "We city-dwellers get dazed from never seeing anything but use-objects; . . . trees,

at any rate, have something independent about them outside myself." Anyone who has felt a mountain's indifference to human events will understand those words. It is as if our awareness of our very dispensability reassures us that the basis of being is itself firm and real. Such reassurance depends on the presence of natural diversity, which manifests the complexity and mystery of natural reality.

We build great libraries to house the diverse elements of our cultural heritage; why not do the same for the elements of our natural heritage? Not everyone would avail himself of the opportunity, just as not everyone uses libraries. But those who did would be enriched. Only by directly experiencing an ongoing culture can one become part of it, and only by directly experiencing diversified nature can one sense one's own peculiar fitness in it. Fortunately, in most of us the impulse toward diversity seems to be still strong. When people talk about going to "the country" for vacation, they do not mean simply getting out of town; they mean finding some version of diversity. A corn field is "natural" and out of town, but it is also fairly monotonous and hardly anyone vacations there.

For reasons of their own sanity and well being, people need a holistic, organic perception of their milieu and their place in it. Prolonged monotony of any sort produces neurosis, for which cultural and natural diversity are the only effective buffers.

The Ethics of Diversity

Even if natural diversity could be shown to have nothing to do with sustaining life on earth, even if we could identify certain species as once and for all useless to us, and even if we decide that we have no inner need for the presence of diversity, we would still have an ethical problem to face before we could countenance the reduction of natural diversity.

As a natural species, *Homo sapiens* is under the same ecological constraints as any other species. If we ignore the ecological facts of life and really try to act as if we had "conquered" nature, sooner or later nature will get even, because no human is that smart. Our best strategy with nature is to adopt the attitude of humility and respect. That is the message of the Land Ethic. That attitude allows us both to be true to ourselves as natural creatures in a natural environment and to exercise human, rational choice in the most prudent way. "In short," says Aldo Leopold, "a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow members, and also respect for the community as such."

A workable land ethic calls for a serious commitment. It requires that we understand the consequences of our actions for other living things, that we accept responsibility for them, and that before we intervene in the functioning of an ecosystem we make sure we have adequate justification. It further requires, as Leopold also pointed out, that we acknowledge the right of other species to continue their existence, "and, at least in spots, their continued existence in a natural state."

Of course someone could argue that ethics only apply to people. Nevertheless, because the web of diversity connects us all, the ethical problem persists. If a farmer drains a marsh in order to replace its abundant diversity with a monocultural empire of soybeans, then quite possibly he has done me some ecological harm. I am entitled to ask by what right he does so and why his rights should supersede mine in this case. If, in addition, the soybean industry happens to cause the extinction of a species or two, it has denied the rest of us an irreplaceable genetic resource. The obliteration of an element of diversity can be a violation of the rights of a great many people.

What is more, the rights that are violated are not ours alone but those of future generations as well. It is not easy to describe the extent of our obligation to posterity, and the whole question can get buried under a mountain of probabilities and "what ifs." What should we save? What will future generations need or want? What would they miss? How much will they want it, so that we know how much we should be willing to sacrifice in order to save it? On the other hand, what if they will not deserve our beneficence? They may be a pack of wastrels themselves, or a race of technocratic automatons, or extinct.

The best we can do in the face of the uncertainties of the future is to recall the land ethic, summon up our humility and respect, and like Leopold's tinkerer who does not understand the machine he is trying to fix, save all the pieces. In fact what is likely to happen is what has always happened. We will save what we love, partly because we want the things we love to endure and partly because we assume that our children will be like us and will love the things we value too. In preserving natural diversity, we are preserving options, the full spectrum of present possibilities, in case one or another is important to someone later. And we are preserving chances for future evolution as yet unrevealed, including perhaps those of *Homo sapiens*. We have inherited a world of extraordinary variety and complexity in which people have survived and flourished for eons. If we love that kind of world, we have no choice but to try to preserve its diversity.

Selection of Natural Areas in Heritage Programs*

The Natural Heritage Program information system makes possible a more objective evaluation of lands and ecological resources for the purpose of identifying the most important natural areas to receive protective attention. The "real data" aspect of the system is of the greatest importance in this regard since it provides a basis for separating fact from opinion in weighing alternatives. The subjective aspects of evaluation are not entirely eliminated, and probably should not be, but they should be clearly distinguished and ordinarily reduced to a secondary position.

The Heritage Program information system has been designed in such a way that different decision-makers with different criteria can utilize the system for their own purposes. In this sense, those seeking to preserve ecological diversity through the active protection of habitat and selected natural areas are simply one kind of user. Even though their interests were a central consideration in designing the system, their criteria are just as exogenous as those of a developer seeking to avoid environmental conflicts. Neither are part of the data bank itself. Therefore the information in the Heritage data bank does not automatically generate a list of natural area priorities. Such a list can only be generated by deliberate and thoughtful analysis.

Criteria For Establishing Natural Area Priorities

There are basically three kinds of criteria for consideration in identifying priority lands for ecological protection:

1. Element considerations - including the rarity of occurrences, the number of occurrences already protected, the status of the element (e.g., globally endangered, nationally endangered, etc.), its ecological fragility, its taxonomic distinctness (e.g., monotypic family vs. multiple species genus), and even the element's ecological role or function (e.g., a once widespread but decimated community type might merit greater attention than one which was always rare and of little quantitative significance). These considerations are listed in declining order of significance and the last few should rarely be given much weight.
2. Site considerations - once the most endangered elements have been identified as the focus of attention, the individual occurrences of these elements must be evaluated for their relative ecological quality (comparing "apples to apples" on the basis of lack of disturbance, apparent health of populations, etc. These criteria will vary widely depending on the

* Dr. Robert E. Jenkins, Vice President for Science, The Nature Conservancy

biology of the element in question). Next to be considered are questions of ecological viability (a complex consideration involving the size of the area, the diversity of habitat, etc., always related to the biological requirements of the target organisms or community), defensibility (again complex, but largely a matter of topographic considerations, off-site encroachments, and keyed to such indicators as the aquatic environment, intolerant or space-requiring species, species at the top of the community pyramid, etc.), and manageability. This last variable and the important question of clustering of occurrences of different endangered elements ("ensembles") bridge the gap to the next class of criteria in that they are partly ecological considerations and partly questions of feasibility and cost-effectiveness.

3. Anthropogenic considerations, including ownership, threat, feasibility of protection, availability of resources, the coincidence of other values which would generate interest and opportunities, existence of a willing donor or prior agency interest, etc.

As can easily be seen, these classes of considerations are not equally important to the ecological conservationist but form a natural hierarchy which is intimately and deliberately related to the structure and development of the data bank. Many of these matters can only be dealt with by gathering additional information in the continuing Heritage inventory process. The collection of additional information is made efficient by "reduction divisions" in preliminary data analysis. In other words, by first gathering information at the LCD level, element by element and occurrence by occurrence, we can analyze the data base to first draw conclusions on the all-important issue of element endangerment. We are then free to concentrate our attention and resources upon additional data gathering for those occurrences and elements of the greatest ecological importance at this time. Intensive field survey, for example, is an expensive process and should be conducted first on the alternative occurrences of the most endangered elements and element ensembles. Gathering ownership information can be similarly concentrated so as to avoid the expenditure of resources on the less critical data needs (i.e., while one is gathering ownership information on a hundred known occurrences of one element, an element with a single known occurrence could be undergoing its final destruction). Extensive field surveys, ensemble evaluation/preserve design surveys, etc., all play a role in selective enrichment of the data bank.

There is great scope in the analysis and use of the Heritage data bank and information system for judgment and insight. We will never know enough about our natural world for the data to lead ineluctably to a sequence of priorities for protection. Balancing what appears to be a slightly less significant but tremendously more feasible natural area alternative against a more significant but less accomplishable one will always remain difficult. The Heritage information system is designed to step into a conceptual and information vacuum to begin sorting out the main needs and opportunities. Adherence to the data theory will continuously strengthen our ability to make and document the proper judgments. The

temptation to abandon the system in favor of beguiling alternatives, such as depending on the "opinions of experts," can be debilitating. Experts worth their salt will have facts as well as opinions, and only the former will strengthen the analytical nature of the data bank.

A Detailed Analytical Scenario

The Natural Heritage data bank structure is designed to perform two basic functions. First, to give us a firmer foundation and process for increasing our knowledge of the existence, numbers condition, status and distribution of the elements of natural ecological diversity through special inventory procedures. Second, to use the increasing body of data to satisfy the needs of decision-makers for objective input. These two uses, depending on the types of decisions, are often interdigitated and should operate synergistically. For instance, analysis of information for any decision-making purpose may identify information gaps which the decision-maker has the resources to fill.

Thus, the Heritage Program begins by establishing a framework for data organization through the classification system, the file structures, and computer system. The LCD data gathering approach is then used to collect and assimilate concentrated information sources for the various file structures, especially on alternative occurrences of the elements distinguished by the classification system. At any time, a review of the data bank through the various information retrieval modes can yield the all-important information on which elements have the least number of known occurrences. Early in the inventory process relative rarity may be largely a consequence of sampling error and will be used therefore to concentrate resources on finding more leads to occurrences of the under-reported elements in the concentrated information perpetually. Eventually it may well yield to a passive exchange of information with the experts as they learn the value of interaction with the data system.

To meet demands for conclusions about priority made early in the history of the data bank, preliminary analysis may generate nothing except a few reported occurrences of nationally endangered species, some apparently unique sites and systems uncovered in inventory, and the priorities of the local academic community. Even this may be useful, but from the very beginning an effort should be made to identify from the data bank the elements with the least number of occurrences, and from among these, those with the least protected occurrences. Any element with only a single occurrence should certainly be put quickly through the lead generation cycle at least one more time. If there are no additional occurrences, it should be considered for extensive field survey to verify its existence and gather some information on its site.

As the data bank matures, analysis can become increasingly objective and rigorous. Occurrences of the rarest and least protected elements will replace the preliminary priorities, though some may be the same. As data accumulates, the other considerations of site quality and feasibility should be increasingly scrutinized. Depending on the needs of the decision-makers, it may be worthwhile to evaluate known opportunities (areas in which an agency is interested, areas owned by a willing donor, etc.) to see how widely they diverge from the top priorities.

Proposed Element Status Summary Approach to Priority Site List

The following procedure is proposed to facilitate the step-wise development of a proposed preserve system adequate to provide protection for occurrences of elements of natural diversity in the state.

(1) The Heritage staff will prepare an element summary package including the element abstract, a printout of the LCD records for each occurrence of that natural element, and information from the Managed Area file for those protected areas containing an occurrence of the element.

(2) From these and other sources, an element status summary sheet (see the following example, figure 11) will be completed to the extent possible by the Heritage staff. The element status summary should provide a framework for the evaluation of element status, the relative quality and suitability for preservation of the occurrences of the element, and the resolution of these factors and considerations into proposals for new preserves that are intended to increase the adequacy of protection for the individual elements of natural diversity. This check sheet approach should concentrate input into the evaluation process by various experts, volunteers, and interested parties.

The staff will record on the element status sheet the index number for each occurrence of the element, its county location, whether it has had extensive and intensive field surveys. The staff will determine from the map files whether important occurrences of other elements are found in proximity and will note this information under the category "ensembles." All available information will be used to derive conclusions about other known site values, interested agencies, opportunities for beneficial uses, and owner attitude.

(3) Using all available sources of information and in conjunction with cooperating experts, an attempt will be made to assess the relative quality, viability, and defensibility of the individual element occurrences. Where this cannot be ascertained from available information, categories will be left blank until the information is acquired.

(4) By analysis of the total recorded information, an overall prospect evaluation will be made for the purpose of defining the best possible sites for proposed preserves adequate to meet the long-term preservation needs of each individual element.

(5) Upon identifying the best prospects, an intense investigation will be made relating to the lands on which the selected elements occur, and a preserve proposal will be developed. Field surveys will be conducted wherever necessary to the accomplishment of this objective. The preserve proposal will include a map showing the recommended preserve boundary and the location of the element occurrence or occurrences for which the preserve is extended. This shall be accompanied by a proposed preserve summary including documentation as follows:

Old Smokey Mountain. Contains the only known occurrences of _____ grass and _____ tree frog for the State of North Carolina and the largest known populations of _____ orchid. The first and third of these species are nationally threatened while the second is on the state endangered list. In addition, the area _____ contains one of the two least disturbed examples of the five remaining known old growth _____ forest stands in the state, and by reference to Heritage data banks elsewhere in the Southeast probably one of the last, best in the country.

Ownerships are several, the main owner being _____ corporation which is interested in selling. Smaller ownerships are being determined at this time. Preserve boundary lines have been proposed (see accompanying map) to incorporate an area of 1,500 acres including the entire top of the mountain and the old growth forest on the southward slope...

ELEMENT STATUS SUMMARY

Element name
 Element code
 Number of occurrences in state
 Number of occurrences on adequately protected preserves
 Status of element throughout its total range
 Element protection status
 Action recommendation
 Existing preserves (list)
 Proposed preserves (list)

Occurrence (index no.; quad code)	County	Ensembles	Other Known Values	Interested Agencies	Beneficial Uses of Site	Owner Attitude	Element Occ. Considerations: Quality-Viability- Defensibility	Overall Prospect Evaluation	Comments	Special Protection Recommendation

Figure 11

Case Example

The following example demonstrates the application of the element status summary approach. The element status summary sheet (see figure 12) is completed from the data base for known occurrences of Pinus palustris - Quercus laevis (longleaf pine - turkey oak plant community). The total element summary package would include, in addition, an descriptive element abstract, printout of the LCD records for each occurrence of the element, and information from the Managed Area file for protected areas containing longleaf pine stands.

While further field investigations for certain occurrences are needed, the element status summary approach does indicate the significance of the longleaf pine occurrence on the Boyd Estate (PC OC.061.005.3507924). The Boyd Estate is the best prospect for preserving this natural element. The proposed preserve summary documentation follows.

Boyd Estate, Southern Pines contains the last known major stand of virgin longleaf pine in North Carolina. The longleaf pine (Pinus palustris) - turkey oak community covers about 60 acres and is composed of about 500-600 pines from 275-300 years of age. The largest tree is 92 feet tall. Soils are mostly coarse sands, sandy loams, and red clays characteristic of the Sandhills region. Three colonies of the nationally-endangered red-cockaded woodpecker (Picoides borealis) occur in the old pines. One colony with 33 cavity holes is the largest, and possibly oldest, red-cockaded colony known in North Carolina.

The total 182 acres is owned by the Sandhills Community College Foundation and was a gift of the Boyd family, who donated the nearby Weymouth Woods as a State Nature Preserve. The College administration has been disinclined to protect the old pine area. The pines are choked with a dense hardwood understory — the product of about 40 years of fire exclusion. Management action is necessary to save the pines and red-cockaded woodpeckers. Boundary lines of the plant communities and the total tract are defined.

The property also has significance as a cultural resource due to presence of the Boyd home and garden. That portion of the estate might be used as a conference center.

There is considerable local sentiment to preserve the estate. An option to purchase the estate has been acquired by the Friends of Weymouth, Inc. and the North Carolina Nature Conservancy.

ELEMENT STATUS SUMMARY

Element name Pinus palustris - Quercus laevis (longleaf pine - turkey oak)
 Element code PC OC. OC.1
 Number of occurrences in state 11
 Number of occurrences on adequately protected preserves 1
 Status of element throughout its total range
 Old-growth longleaf pine presently unprotected in North Carolina and South Carolina *
 Element protection status Protect Boyd Estate
 Action recommendation Weymouth Woods SNP
 Existing preserves (list) Boyd Estate
 Proposed preserves (list) (The element is secondary in quality and importance at Patsy Pond and Bushy Lake)
 * The South Carolina Heritage Trust informs us that SC has no larger virgin stands and none there are protected.

Longleaf pine once dominated the landscape of the Carolina sandhills and coastal plain; now old-growth pines are severely reduced to a few, small remnants.

Occurrence (index no.; quad code)	County	State	Ensembles	Other Known Values	Interested Agencies	Beneficial Uses of Site	Owner Attitude	Element Occ. Considerations: Quality-Viability-Defensibility	Overall Prospect Evaluation	Comments	Special Protection Recommendation
001 3507718	Wayne	Y	N			General park recreation	Cliffs of Newse St. Park general park management	Small area, young growth across river from cliffs on periphery of park	not a high quality example of longleaf pine		
002 3507718	New Hanover	N					unknown				
003 3507827	Cumberland	N					Methodist College campus	open sandhill on campus			
004 3407383	Cumberland	N	Kalmia cuneata nearby				unknown				
005 3507924	Moore	Y	N	Cultural heritage	NC Nature Conservancy/Friends of Weymouth	educational/scientific	Sandhills Camp College not protection minded	probably the only virgin longleaf pine stand in excess of one acre in NC. Tallest tree 92 ft. 600 pines, 275-300 yrs old, 60 acres. Boyd Estate	excellent example of longleaf pines perhaps largest, oldest red cockaded woodpecker colonies in NC	could be managed by Weymouth Woods St. Nat. Pres.	should be protected for preservation of longleaf pine community and woodpecker colonies

Figure 12

Occurrence (index no.; quad code)	County	Ext. Survey Y/N	Int. Survey Y/N	Ensembles	Other Known Values	Interested Agencies	Beneficial Uses of Site	Owner Attitude	Element Occ. Considerations: Quality-Viability- Defensibility	Overall Prospect Evaluation	Comments	Special Protection Recommendation
006 3507923	Moore	Y	N	Red-cockaded woodpeckers several E/T plants in pre- serve, outside longleaf area	State Nature Preserve		educational scientific	Waymouth Woods SNP Protected by State Park management	active management to maintain longleaf pines; pines are mature but not old growth; approx 60 yrs age	protected as natural preserve		maintain preservation management practices
007 3507931	Harnett	Y	N	Pyxidanthera barbulata var brevifolia Coreopsis gladiata				Spot Springs unknown ownership	tallest tree is 47' oldest are 64-76 yrs old development probable from many directions	needs further investigation		
008 3407985	Scotland	N	N	Red-cockaded woodpeckers			hunting recreation	Savannah WRC - timber management by RC woodpecker conservation	longleaf pine not managed for natural areas protection	certain sectors within wetland will need greater protection	needs more field investigation	work with WRC on conservation management plan
009 3407986	Richmond	N	N	Patanogeton conferovides Scirpus subterminalis			educational	owner unknown; development likely	longleaf pines on rim of old lake bed	needs further investigation		
010 3407875	Cumberland	Y	Y	Kalmia cuneata, Rhynchospora alba in bay bed			educational- scientific	partly state owned, general public lands	longleaf pines on bay rim; not an outstanding example Bushy Lake	high significance due to natural diversity of bay area	high priority for preservation on basis of its other natural elements	should be public natural preserve
011 3407668	Carteret	Y	Y	Six E/T plant species recorded from the area			educational- scientific	Croatan NF USFS wishes to protect area	not an outstanding example of longleaf pines Patsy Pond	high significance as natural area due to other characteristics of pond area	high priority for preservation on basis of its other natural elements	work with USFS for protective management

PROGRAM PROGRESS AND RESULTS

- 1. The first phase of the program was the development of a pilot community-based system of health services.
- 2. The second phase was the development of a pilot community-based system of health services.
- 3. The third phase was the development of a pilot community-based system of health services.
- 4. The fourth phase was the development of a pilot community-based system of health services.
- 5. The fifth phase was the development of a pilot community-based system of health services.
- 6. The sixth phase was the development of a pilot community-based system of health services.
- 7. The seventh phase was the development of a pilot community-based system of health services.
- 8. The eighth phase was the development of a pilot community-based system of health services.
- 9. The ninth phase was the development of a pilot community-based system of health services.
- 10. The tenth phase was the development of a pilot community-based system of health services.

PROGRAM PROGRESS AND RESULTS

Highlights of Program's First Year

June 1976

- C. Roe is hired and trained by The Nature Conservancy as field coordinator for the NC Natural Heritage Program.

July 1976

- J. Williams is hired as secretary and data processor.
- F. Huber and L. Peacock are hired as research assistants.
- Program's objectives are introduced to state agency representatives and academic authorities concerned with natural areas identification, protection, and management.
- Inventory data management system is established.
- Office space is assigned.

August 1976

- Classification system is developed for the natural elements to be inventoried - endangered or threatened plants and animals, representative or unique plant communities and physical features.
- Task force meeting of scientific authorities agrees upon a plant community classification following the "Radford system."
- Catalog and information collection on the state's managed and protected lands is compiled.
- Coordination with NC Botanical Gardens is established.
- Staff visits national natural landmarks and other unique natural areas in northwestern NC.
- Computer system is established for natural element information storage and retrieval.
- Pilot inventory begins as staff gathers information on natural element occurrences from state park files and national landmark proposal studies.

September 1976

- Graduate students and State Museum assistant curator are hired as part-time research aides.
- State furnishes topographic and orthophoto maps for our use to record locations of special elements of natural diversity. Walls for our office area construction completed.
- The Nature Conservancy begins its efforts to establish a branch office and organization in North Carolina.
- Information is gathered for evaluation and recommendations to be made concerning the state's ability to protect important natural areas.

October 1976

- Pilot inventory proceeds with 450 individual records completed on occurrences of special natural elements.
- NC Natural Heritage Program public information brochure is completed and distribution begun.
- Coordination meetings are held with the staff of the NC Land Policy Council.
- Heritage staff takes an information collection trip to confer with naturalists and managers of the Great Smoky Mtns National Park, US Forest Service, and Blue Ridge Parkway, and with professors at Western Carolina University.

November 1976

- Staff collects information on natural element occurrences from East Carolina University faculty and US Fish and Wildlife Service officers and refuge managers (Mattamuskeet, Swanquarter, Pungo, Cedar Island).
- Meeting is convened in Nashville, Tenn. for Natural Heritage Program staffs of six states and TVA.
- We begin to provide information to other public agencies for environmental impact assessment and project planning.
- Natural Areas Advisory Committee for the Department of Natural and Economic Resources meets to discuss its future role and to learn of the progress of the Heritage Program.
- Good working relationship continues with the State Museum of Natural History.
- NC Wildlife Resources Commission proposes an endangered

species program of research and management under its direction.

- We begin preparation of reports on identification and protection of significant natural areas.

December 1976

- Information on natural element occurrences is collected from Highlands Biological Station, US Forest Service, and faculty at UNC-Asheville, Western Carolina Univ., Mars Hill College.
- Requests for student reports on natural areas and special habitats are made to over fifty of the state's professors.
- The Department of Natural and Economic Resources releases a news feature on the Natural Heritage Program, and the Wildlife Resources Commission magazine describes the efforts of The Nature Conservancy and the Heritage Program in NC. Over 6000 Heritage brochures are distributed to interested citizens and public officials (10,000 brochures are distributed by the end of the year).
- Over 1200 occurrences of elements of natural diversity are recorded on quad maps, files, and computer data bank.
- Information requests from other public agencies and public utilities are received and filled on a regular basis.

January 1977

- Information collection search made with the Cape Hatteras National Seashore naturalist, Pea Island Wildlife Refuge manager, and ECU geologists. Natural element report gathering continues in the UNC-CH and Duke herbariums and State Museum.
- Presentations on the Heritage Program are made before meetings of the American Institute of Planners NC chapter and NC Task Force on the Rural Environment.
- We give attention to the important Nags Head Woods and Bluff Mountain natural areas. Meanwhile, The Nature Conservancy conducts negotiations toward protection of a number of other natural areas in the state.

February 1977

- We continue discussions with representatives of state agencies concerned with natural areas protection and management.
- Advisement and review of our natural element information base is sought from state park naturalists, State Museum curators, and federal agency naturalists.
- Search begins to assemble natural element occurrence information from Wildlife Resources Commission studies.
- Information collection trip is made to Wilmington area in order to receive data from UNC-Wilmington faculty, Army Corps of Engineers, Fort Fisher Marine Resources Center staff, and park naturalists; and to visit natural areas in the southeastern region of the state.
- A taped 30-minute interview on the Heritage Program is prepared by WWAY-TV.
- Staff continues observations of management practices on nature preserves in preparation for our future increased involvement with natural areas management planning and recommendations. Staff participates in a prescribed burn at Weymouth Woods and reviews resource management practices at Fort Bragg.
- Collection of natural element occurrence information is completed from UNC-CH and Duke herbariums.
- DNER Natural Areas Advisory Committee meets and asks the Department for a participatory role in policy analysis and planning for state parks and natural areas.

March 1977

- Pilot inventory of elements of natural diversity reaches 2800 individual occurrence records — information on location, ownership, endangerment status, protection, verification of presence, description of the feature, and field survey work is registered on quad maps, files, and computer retrieval bank.
- Our handbook, "Conservation Easements: To Preserve North Carolina's Heritage," authored by Roe and Peacock, co-sponsored by numerous conservation organizations and prepared by UNC Press, is published and made available in quantity to interested property owners and conservation groups.

- Counties and regional councils of government begin using natural element information assembled by the Heritage Program for local land planning. Use of our information continues by state and federal agencies and public utilities for planning and environmental impact assessment.
- Work continues on reports and recommendations on the state's recognition and protection of significant natural areas.
- Natural element information is assembled with cooperation of zoologists at state universities and colleges.
- Trip is completed to the coast to gather information, visit natural areas, and observe management practices. Included are the Croatan National Forest, state and federal marine fisheries, Bogue Marine Resources Center, Camp Lejeune Marine Corps natural resources division, Cape Lookout National Seashore, Mariners Museum, Bird Shoals, Carrot Island, Roosevelt Natural Area, and discussions with area authorities.
- Visit is made to the Charlotte area to confer with the state park regional naturalist, Pee Dee wildlife refuge manager, UNCC faculty, and to tape a television interview.
- Extensive field inventory "trial runs" by Heritage research staff begin in cooperation with UNCC botany department.

April 1977

- Conference on the potentials and techniques of conservation easements to protect natural lands is co-sponsored by The Nature Conservancy and NC Institute of Government, with our participation. The meeting attracts 90 public officials, bankers, conservation leaders, attorneys, appraisors, assessors, and planners.
- NC Nature Conservancy holds its first board of advisors meeting.
- Coordinator meets with staff of Coastal Resources Commission to discuss the Heritage Program review of nominations for "areas of environmental concern."
- Tennessee Valley Authority Heritage staff visits our offices and trades information.
- Annual meeting of the Association of Southeastern Biologist is held in Raleigh at NCSU. One session, co-sponsored by The Nature Conservancy, is devoted to papers on the recognition and protection of natural areas.

- Heritage information base reaches 3300 natural element occurrence reports.
- State agrees to extend contract with The Nature Conservancy to continue the Heritage Program until October.
- Staff researchers conduct intensive field survey of Nags Head Woods, a "threatened" national natural landmark.
- Staff visits Dismal Swamp and Merchant Mill Pond parks and refuge to receive natural element data and to discuss natural area management plans and alternatives.
- Staff visits Currituck Banks to survey property and report to a national conservation organization considering purchase for a nature preserve.
- Staff prepares for trip to mountain region to survey natural areas that are subjects of acquisition efforts.
- DNER Natural Areas Advisory Committee meets and discusses its future responsibilities and advisory functions for state park and natural area policies and plans.
- A symposium on North Carolina's natural areas identification and protection needs is sponsored by the UNC Environmental Studies Council, to improve understanding of efforts to recognize and protect natural areas and to integrate university and state efforts.

Note: A concise timetable of Heritage phases and tasks is appended (figure 13).

NORTH CAROLINA STATE HERITAGE PROGRAM

1976-77

INVENTORY PROCESS

Phase I: Program Develop.

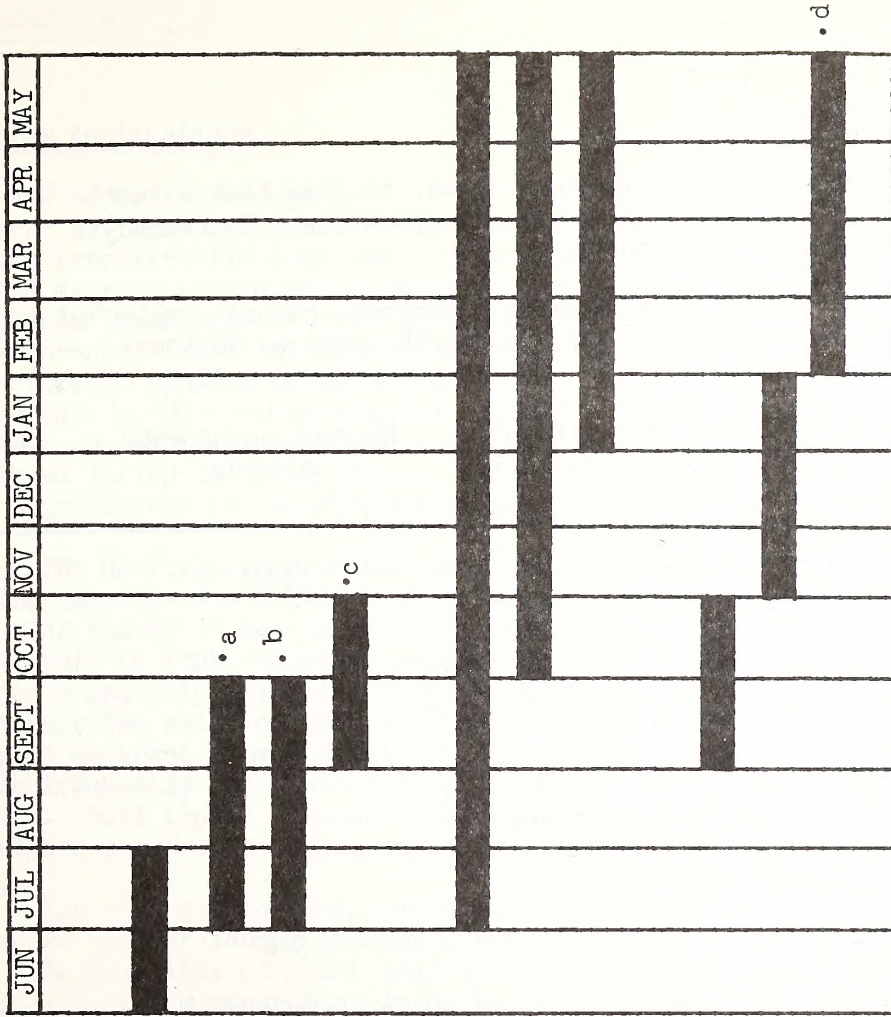
- TASK 1: Plan & establish operations
- TASK 2: Generate working classifications
- TASK 3: Install data management system
- TASK 4: Develop operations handbook

Phase II: Pilot Program

- TASK 1: Collect data
- TASK 2: Process data
- TASK 3: Analyze data

PROTECTION PLANNING

- TASK 1: Organize study
- TASK 2: Survey
- TASK 3: Recommendations



*PROGRAM PRODUCTS: a. Classification System b. Install Data Management c. Handbook for N. C.
d. Protection/Preservation Recommendations

figure 13

Inventory Progress

The North Carolina Heritage Program in less than a year's time has assembled the largest data base of the Nature Conservancy's ten sponsored Heritage programs.

As of May 1, 1977, the element occurrence records collected by the Heritage Program totaled 3325 and broke down as follows:

	Natural elements being inventoried	Element occurrence records	Elements without documented occurrences
Special Animals	184	949	19
endangered	35		1
threatened	31		0
special concern	81		17
undetermined	37		1
Special Plants	410	1581	50
endangered	276		40
threatened	134		10
Plant Communities	—	359	—
Physical Features	75	394	25
Special Habitats	—	42	—

Program Applications

A major long-range goal of the North Carolina Natural Heritage Program is to assist public and private organizations in the protection of the irreplaceable components comprising the state's natural diversity. Varied degrees of protection results from the application of cogent biological knowledge to early planning for development projects, environmental impact statements and assessments, regional resource inventories, appeals by public interests in support of significant areas, and to directed scientific research. Table I lists many of the studies and activities in which Heritage Program staff and data were employed during the pilot year. Such applications will grow in number and significance as the Program matures.

The Heritage Program has been pleased to fulfill requests by public agencies and public utilities seeking data for the early planning phases of development projects. Such working relationships contribute to improved environmental impact assessment for proposed projects and help minimize or avoid unnecessary and adverse ecological impacts. The value of this application of Heritage Program information is most apparent from the review of past environmental impact statements, which frequently contained data gaps on matters of imminent environmental impact. Most impact statements reviewed by Heritage Program staff exhibited some of the following deficiencies:

1. No consideration of plants or wildlife.
2. Some faunal analysis, but no floral consideration.
3. A list of plant and/or animal species which was derived from range maps found in field guides.
4. A general discussion of common wildlife and flora, but no mention of possible impact on these animals and plants by the project.

The application of information available from the Heritage Program's data base and resource catalog should serve to improve federal and state environmental impact assessments and to reduce impacts on important natural elements.

Heritage Program data is collected from reliable, recognized sources. A catalog of resource persons, publications, and other references has been prepared and organized by region and subject of expertise during the Heritage Program's implementation. This information is available to planners upon request for specific subjects.

Program staff have prepared and provided information on conservation easements, which are a potentially important protection technique. The Heritage Program has made numerous presentations before local conservation groups concerned with natural area protection. The Program will be increasingly engaged in public education and encouragement of land conservation by private property owners.

TABLE I

STUDIES AND ACTIVITIES IN WHICH HERITAGE STAFF AND DATA WERE EMPLOYED DURING CONTRACT PERIOD

FEDERAL

SOIL CONSERVATION SERVICE

- Provided recommendations for SCS registry of managed natural areas
- Provided information on conservation easements
- Provided critical species and element occurrence data for Iredell County

CORPS OF ENGINEERS

- Provided critical species and element occurrence information for lower Neuse River basin
- Provided critical species and element occurrence information for Dan River basin
- Reviewed Bald Head Island, Phosphate Mining, Wilmington harbor environmental impact statements
- Provided information on conservation easements

FISH AND WILDLIFE SERVICE

- Exchanged data with refuge managers, technical services, and Office of Endangered Species
- Provided information on critical species and element occurrences for Dan River basin

NATIONAL PARK SERVICE

- Exchanged data with Great Smoky Mountains NP, Cape Hatteras NS, Cape Lookout NS
- Provided listing of special species locations in Great Smoky Mountains NP for park master plan and environmental assessment
- Provided NC list of endangered and threatened species to GSMNP

FOREST SERVICE

- Exchanged data with biologist in NC national forest supervisor's office

TENNESSEE VALLEY AUTHORITY

- Exchanged data on critical species and feature locations

HOUSING AND URBAN DEVELOPMENT

- Provided information requested on special species locations near Little River reservoir project

STATE

DIVISION OF PARKS AND RECREATION

- Provided element data for park master plans and environmental assessments
- Reviewed draft environmental impact statements for state parks
- Provided natural element data for state parks and state natural areas to regional naturalists
- Provided information on conservation easements
- Exchanged information on critical species and element locations with park naturalists
- Provided access to element data for division's A-95 reviews of 201 projects

WILDLIFE RESOURCES COMMISSION

- Exchanged information on natural elements on state gamelands
- Prepared article and announcements for "Wildlife in North Carolina" magazine
- Provided information on conservation easements

COASTAL RESOURCES COMMISSION

- Agreed to review local nominations for "areas of environmental concern" -- complex natural areas, remnant species habitats, unique geologic features
- Provided information on conservation easements
- Provided information on estuarine and marine sanctuary grant programs

DIVISION OF MARINE FISHERIES

- Provided information on conservation easements

LAND POLICY COUNCIL

- Agreed to cooperate in information services to local governments

DIVISION OF ENVIRONMENTAL MANAGEMENT

- Provided access to Heritage data base to 201 Task Force for their reviews and instructions for local waste treatment projects
- Agreed to provide natural element occurrence information to state 208 Task Force

DEPARTMENT OF TRANSPORTATION

- Reviewed A-95 and environmental impact statements
- Provided critical species and element location information for pre-planning of proposed highway projects

MARINERS MUSEUM, STATE MUSEUM

- Provided critical species and element occurrence data for Carteret County

LOCAL GOVERNMENTS

RESEARCH TRIANGLE J COUNCIL OF GOVERNMENTS

- Provided data on critical species and elements in Chatham County

PIEDMONT TRIAD COUNCIL OF GOVERNMENTS

- Provided data on critical species and elements for 11-county area

ORANGE COUNTY PLANNING DEPARTMENT

- Provided data on critical species and elements in county for purpose of subdivision regulations

GUILFORD COUNTY PLANNING DEPARTMENT

- Provided data on critical species and elements in county for purpose of land use plan

PRIVATE AND UNIVERSITY

NC BOTANICAL GARDENS

- Provided information on critical species research in North Carolina

WALTON (NCSU)

- Provided ownership information on rookery sites for Ph.D. study

FULLER (NCSU)

- Provided formal endorsement for proposed research on alligators in NC (grant received)

CAROLINA POWER & LIGHT

- Provided critical species information for Mayo Creek project planning area

- Provided critical species data for transmission line project plans

DELCOURT (U MINN)

- Provided information on mountain bogs for paleovegetational research

KAUFMAN (JOHNS HOPKINS)

- Provided general information on research on insectivorous plant habitats and their protection

AUDUBON SOCIETY

- Provided natural features information on several areas of interest as Audubon preservation projects

MOORE, GARDNER, CONSULTANTS

- Provided data for critical elements in fourteen 201 project planning areas

WILLIAMS AND WORKS CONSULTANTS

- Provided data for 201 facility plan

LEARY (NCSU)

- Provided information on critical species and elements in Polk County

HEDIGER (DUKE)

- Provided our element data in Orange County for landfill site capability analysis

RESEARCH TRIANGLE INSTITUTE

- Provided data for critical species and elements for Asheville 201 planning area

PEIRSON AND WHITMAN, CONSULTANTS

- Provided information on critical species for 201 planning areas

SENECA (NCSU)

- Provided locational information on mature loblolly pine communities

NC NATURE CONSERVANCY

- Provided recommendations for protection actions for significant natural areas in NC
- Provided detailed site information for natural areas under consideration for acquisition

Ecologically Significant Areas

An important product of the Natural Heritage Program is the identification and recognition of ecologically significant areas throughout the state. These sites represent remaining portions of the original natural landscape and habitats of remnant native species of North Carolina that should be protected in order to perpetuate natural diversity.

The Heritage Program, in its pilot stage, has advised The Nature Conservancy on various natural areas of special interest and has provided data on areas considered for preservation action. As the Program matures, it will increasingly provide recommendations to the state regarding management for publicly-owned natural areas and priorities for public and private protective actions.

The Heritage Program will begin immediately to apply the proposed element status summary approach for developing lists of priority natural areas and to prepare documentation summaries for proposed preserves.

Protection of Natural Diversity

Recommendations



Protection of Natural Areas

THE NATIONAL SYSTEM OF PUBLIC LANDS
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

Recreation Management



PROTECTION OF NATURAL DIVERSITY

The agreement entered into on April 1, 1976 by and between the State of North Carolina and The Nature Conservancy required the Conservancy to "Assist the STATE in analyzing preservation/protection alternatives and make recommendations." The following constitutes a preliminary response to this obligation. The response is preliminary because both the Conservancy and the State expect to benefit from feedback which should be forthcoming to the proposed natural areas bill contained herein. This feedback should come from the individuals in the state long concerned with the protection of the state's natural diversity.

Before it is possible to analyze preservation/protection alternatives for the State of North Carolina and to make recommendations based on such an analysis, it is necessary to have a picture of existing legal and administrative structures within the state. If existing structures are adequate or if they need only a minimum of reshaping, recommendations for the effective protection of natural diversity within the state will be quite different from the case where there are serious gaps or deficiencies. Section one of this chapter is an attempt to supply the needed overall framework analysis.

It is also necessary to be acquainted with the wide variety of legal and administrative techniques which it is possible to use to achieve protection of natural diversity. A discussion of such "tools," based on the Conservancy's experience with Heritage and non-Heritage states follows as section two. The advantages and disadvantages of a variety of such tools are discussed in some detail.

Section three contains a preliminary draft of a bill creating North Carolina Heritage Trust System. This preliminary draft attempts to fill in a gap the Conservancy perceives in the legal authority of the state's executive branch to deal effectively with the protection of the full array of the elements of natural diversity the Heritage Program will identify. The draft attempts to incorporate a number of the legal and administrative techniques discussed in section two and to design a mixture of forms or protection suitable for North Carolina.

The chapter concludes with discussions of the work of The Nature Conservancy in North Carolina to protect the state's natural heritage.

North Carolina State Natural Areas Activities

I. Introduction

II. Natural Resource Agencies

- A. Division of Parks and Recreation
- B. Division of Forest Resources
- C. Division of Marine Fisheries
- D. Wildlife Resources Commission

III. Related Programs and Legislation

- A. Coastal Area Management Program
- B. State Museum of Natural History
- C. Land Policy Council
- D. Office of Marine Affairs
- E. Natural and Scenic Rivers System
- F. Natural Heritage Program
- G. Natural Areas - Advisory Committee
- H. National Natural Landmarks
- I. Wetlands Protection Act
- J. North Carolina Environmental Bill of Rights
- K. State Nature and Historic Preserve Dedication Act
- L. North Carolina Land Conservancy Corporation

IV. Bibliography

North Carolina's State Natural Areas Activities

I. Introduction

The Executive Organization Act of 1973 established a system of state agencies designed to accomodate a growing concern for the state's natural resources. The Department of Natural and Economic Resources and the Department of Administration, although separate agencies, are both concerned with developing an effective natural areas program. Although numerous pieces of legislation have been passed and environmental programs have been initiated within these agencies, a comprehensive program for environmental and natural areas protection has not been developed.

The Department of Natural and Economic Resources was created to perform all executive functions of the state in relation to economic development and the protection and management of natural resources. The Department is responsible for the coordination of policies for seven divisions. The Division of Parks and Recreation has made significant steps toward developing a comprehensive natural areas system through a process of designating areas (there are three at present). The Division is inventorying ecological sites which have potential as natural areas. The Division is involved in the formulation of North Carolina's Natural Heritage Program in cooperation with The Nature Conservancy.

The Department of Administration is responsible for coordinating management planning for major resource areas. The Department is responsible for acquiring lands that are administered by various state agencies, including those under the jurisdiction of the Department of Natural and Economic Resources. The Department also supports the activities of the Land Policy Council. This is the vehicle through which various land management policies and programs are recommended to the Governor and the General Assembly.

The Wildlife Resources Commission, quasi-independent of the Department of Natural and Economic Resources, is responsible for the State's Endangered Species Program, but does not administer any designated natural areas in its system of gamelands.

North Carolina's Coastal Area Management Program and its land use policy are still in their formative stages, concentrating primarily on establishing guidelines for a statewide policy. The Coastal Area Management Program is also involved in identifying areas of environmental concern whose natural status is severely threatened.

The citizens of North Carolina displayed their concern for protecting the state's environment by ratifying, in 1972, North Carolina's Environmental Bill of Rights as an amendment to the state constitution. This amendment adds a section requiring the conservation of all natural resources.

Citations from North Carolina's Revised Statutes are labeled NCGS.

II. Natural Resource Agencies

A. Division of Parks and Recreation

The Division of Parks and Recreation operates 28 state parks comprising 79,000 acres, as well as the State Zoo and Kerr Reservoir recreational facilities. It provides public use facilities for passive and active recreation. The Division has inventoried potential natural area sites for incorporation into a state natural areas system. Through the Natural Heritage Program further inventory and acquisition of natural areas is anticipated. Activity in state park natural areas will be limited to ecological study and aesthetic appreciation. The only development in some areas will be interpretive trails and information centers. The Division sees the preservation of natural areas as the best means to protect rare and endangered species of plants and wildlife.

North Carolina's system of state natural areas was authorized in 1963 by the Board of Conservation and Development with the establishment of Weymouth Woods. This 400-acre tract in the sandhills region was not formally dedicated until 1970. The area provides interpretive facilities which illustrate the natural history of the region. An other area in the system is Theodore Roosevelt Natural Area, a 300 acre coastal area of maritime forests and marshlands donated to the state by the Theodore Roosevelt family. Mitchell's Mill natural area, with its granitic flatrocks and primary successional plant communities, was donated to the Division in 1976. Portions of six state parks are registered National Natural Landmarks.

The Division's interpretive program began in 1915. The program portrays and explains the natural features and resources of the parks. The program also acts to protect plants, animals and natural features within the parks. Increased public interest in the environment has prompted an increase in the interpretive program. Three of the parks have full-time naturalists available during the off-season, with additional staff available during the summer months.

The Division is responsible for the North Carolina outdoor recreation plan. This program involves an inventory of the outdoor recreation supply and public demand; an analysis of the need for, and costs of, providing outdoor recreation areas; and special studies concerning natural and scenic rivers, lakes and reservoirs, trails and scenic roads, islands, and other recreational issues.

Reference chart

Comprehensive Natural Area System	Other Natural Area Activities	Administer- ing Agency	Authority	Units/ Acres
	natural areas	Division of Parks and Recreation	NCGS, ss. 143B-113	2/700
	Endangered Species Program	Wildlife Resources Commission	NCGS, ss. 113-102	-
	Coastal Area Management Program	Department of Natural and Economic Resources	NCGS, ss. 113A-100 <u>et seq.</u>	-
	Natural and Scenic Rivers System	Department of Natural and Economic Resources	NCGS, ss. 113A-421	2/39miles
	Land Use Policy Act. 1974	Department of Adminis- tration	NCGS, ss. 113A-155	-
	North Carolina Natural Heri- tage Program	Department of Natural and Economic Resources	Department of Natural and Economic Resources' General Authorities	-
	National Natural Landmarks	Division of Parks and Recreation	administra- tive	5/3,103*
	Wetlands Protection Act	Department of Natural and Economic Resources	NCGS, ss. 113-229. <u>et seq.</u>	-
	North Carolina Environmental Bill of Rights	State of North Caro- lina	Article XIV, s. 5, Con- stitution of North Caro- lina	-
	State Nature and Historic Preserve Dedi- cation Act	Department of Natural and Economic Resources	NCGS, ss. 143-260.6 through 143-260.9	-

*(acreage may also include federal and private land)

The Division administers and manages all state park lands and the state recreation system. The major responsibility of the Division is to create a parks and recreation system that meets a wide range of people interests and needs. (NCGS, ss. 143B-113)

B. Division of Forest Resources

The responsibility for forest management advice and assistance, fire prevention and control, reforestation, and educational activities for all state and privately-owned forest land rests with the Division of Forest Resources of the Department of Natural and Economic Resources (NCGS, s. 113-8). The Division operates no natural areas, only state forests which are used for the economic and social benefits to be gained by the application of forest management.

There are a total of six state forests comprising 34,161 acres. Five of these areas are classified as "small state forests" and are used for presenting educational demonstrations as well as to provide active and passive recreational activities. Hunting is allowed on the larger forest, but is prohibited on the five smaller areas. Fishing is permitted in waters suitable for such activities. Some areas are also used for commercial timbering and the production of other forest products. The Division also operates four forest tree nurseries which are used to restock North Carolina's 18.2 million acres of state and privately-owned commercial forest lands.

C. Division of Marine Fisheries

The North Carolina Division of Marine Fisheries is responsible for the conservation of North Carolina's marine fisheries resources. Its programs are designed to allow optimum harvest of seafood species and sport fish, year after year.

The Division meets these responsibilities along a 320 mile coastline and a complex two million acre estuarine system. Law enforcement, utilizing large and small patrol boats and pontoon-equipped aircraft, is a major tool in North Carolina marine fisheries management. Research activities include life history and stock inventory studies of anadromous fishes, shrimp, bay scallops, and estuarine juvenile fishes. Management practices include establishment of nursery areas, private shellfish leases of public bottoms, planting of oyster cultch reefs, construction of artificial fishing reefs, and a close monitor of developing stocks.

All excavation and filling operations in estuarine waters, tide-lines, and marshlands are monitored, and controls are applied to reduce adverse alterations of these areas essential for rich and varied marine fisheries populations. The Division is responsible for implementing the 1969 Wetlands Protection Act.

D. Wildlife Resources Commission

The Commission, a division of the Department of Natural and Economic Resources, is the state agency responsible for the surveillance, management and protection of all wildlife (NCGS, ss. 143B-281). The Commission regulates hunting and fishing and enforces related laws. There are no designated natural areas under its 180,000 acre jurisdiction. The Commission is, however, the agency responsible for the state's Endangered Species Program, and has been so determined by cooperative agreement with the US Fish and Wildlife Service.

III. Related Programs and Legislation

A. Coastal Area Management Program

The Coastal Area Management Act of 1974 is designed to achieve the orderly and balanced use and preservation of North Carolina's coastal resources. A 15-member Coastal Resources Commission, appointed by the Governor and supported by a professional staff within the Department of Natural and Economic Resources, was created by the Act to form regulations and guidelines for development projects in the 20 coastal counties.

The Act provides two mechanisms to develop a coordinated approach to coastal resource management: first, the formulation of local land use plans, and second, the designation of critical resource areas of statewide concern within the coastal area. Although CAMA is in its administrative infancy, all the coastal counties have submitted land use plans and the commission has prepared guidelines for designating "areas of environmental concern" (AEC's). To prevent destruction of the features which make the coast economically, aesthetically, and ecologically rich, the Act charges the Coastal Resources Commission with the responsibility for identifying specific types of areas where uncontrolled or incompatible development might result in irreversible damage. The Act instructs the Commission to determine what types of development activities are appropriate within such areas, and it calls on local government to give special attention to these fragile and important areas in their land use plans. The Act provides that the Coastal Resources Commission should implement a permit program to control inappropriate or damaging development activities within the AEC's. Implementation responsibilities of the permit program are divided between local governments and the Commission. The intent is not to stop development, but rather to ensure the compatibility of development with the continued productivity and value of critical areas.

The Commission has adopted interim areas of environmental concern and later in 1977 will formally designate the AEC's from among the categories of critical land and water areas including:

- (1) Estuarine System -- estuarine waters, coastal wetlands, public trust areas, and estuarine shorelines;
- (2) Ocean Hazard Areas -- beaches, frontal dunes, inlet lands, excessive erosion areas;
- (3) Public Water Supplies -- surface water supply watersheds and well fields;
- (4) Fragile Coastal Natural Resource Areas -- complex natural areas, unique geologic formations, areas that sustain remnant species.

The Act represents an innovative approach to a comprehensive land and water management program. The political controversies and unresolved legal and technical issues make the Act's ultimate effectiveness uncertain, but the Coastal Area Management Program has important potential for protection of important ecosystems and natural areas.

B. State Museum of Natural History

The State Museum of Natural History, a part of the N. C. Department of Agriculture, has established a high degree of excellence in zoological research and environmental education. The Museum sponsors a variety of education programs, and operates the interpretive Hampton Mariners Museum at Beaufort. Scientists in the Research and Collections Division are engaged in ecological studies and provision of information to governmental agencies, educational institutions, and other scientists. The Museum has sponsored preparation by expert scientific committees of a list of North Carolina's endangered and threatened animals and plants. The list, however, is not backed by state regulations.

C. Land Policy Council

Recommendations by the Land Policy Council, created by the N. C. Land Policy Act of 1974, are currently under consideration by the Governor and General Assembly. If the Governor and Legislature are receptive to the proposals of the Land Policy Council and its companion citizen's advisory committee, the result could be a new direction for land management in North Carolina.

The Council's recommended land policies include: (1) development of a state land policy for use by state agencies, regional organizations, and local governments as a guide in the land-related aspects of their programs; (2) preparation by local governments of land classification plans expressing local intent regarding growth and development; (3) development of a land information service to assist state and local agencies, regional organizations, and citizens; and (4) development of an organizational structure that will allow state government to coordinate its existing land-related activities.

The Land Policy Council has considered statewide extension of the Coastal Area Management Act's program to identify and regulate areas of

environmental concern, but deferred recommendations to the General Assembly until the coastal experience can be monitored. Instead, the Council advises that local governments identify areas of environmental concern -- including such "fragile lands" as unique natural areas, wetlands, water supply areas, and historic properties and archaeological sites -- in the process of preparing local land classification plans.

The Land Policy Council has further recommended that it be replaced with a land resources commission, including sub-committees representing geographic regions. The Council and its staff are now part of the Department of Administration, but, with approval by the General Assembly, a land resources commission and its staff would likely be made part of the Department of Natural and Economic Resources.

D. Office of Marine Affairs

The Office of Marine Affairs, which is a part of the Department of Administration, coordinates marine research and manages the state's three marine resources centers. The office has responsibility for marine sanctuaries and estuarine sanctuaries in North Carolina. Both programs are administered by the US Department of Commerce's National Oceanic and Atmospheric Administration.

The Marine Sanctuaries program (established by the federal Marine Protection, Research, and Sanctuaries Act of 1972, section 302) has to date established only two sanctuaries -- the first being the Monitor site off North Carolina and the second being the Key Largo reef off Florida.

The Estuarine Sanctuary program (developed in the federal Coastal Zone Management Act of 1972, section 312) has envisioned inclusion of eighteen representative bio-geographic units in the national system. To date areas in Oregon, Georgia, Florida, Hawaii, and Louisiana have been selected or are being seriously considered. In 1974 and 1975 the Office of Marine Affairs prepared draft proposals for three estuarine sanctuaries in North Carolina, but for a variety of reasons these proposals were never officially submitted to NOAA for consideration.

The Beach Access and Island Preservation program (authorized by section 315(2) of the Coastal Zone Management Act Amendments of 1976) has not yet been funded, nor have regulations for the program been prepared. No state agency has been delegated responsibility for the program.

E. Natural and Scenic Rivers System

The 1971 North Carolina Legislature established a policy for maintaining certain rivers which possess outstanding natural characteristics. The legislation points out the importance of a balance between human conduct and preservation of natural beauty along such waterways (NCGS, s. 113-421). To insure this balance the Natural and Scenic Rivers System was established.

The Department of Natural and Economic Resources, Division of Parks and Recreation, is the State agency responsible for administering

the Act. The system includes Class I rivers which are predominately primitive, natural streams, and Class II rivers, similar to Class I but with harmonious cultural uses. The criteria for inclusion in the system are that the waterways be no less than one mile in length, their visual horizon no less than twenty feet, and their accessibility very limited.

Areas for inclusion are acquired by the Department of Administration by purchase or donation; scenic easements may also be acquired. A management plan is prepared for each river included in the system. Local advisory committees assist with the surveys and management of the rivers. To date two rivers have been included in the system. In 1975 the General Assembly designated 13 miles of the Linville River as a scenic river (NCGS, s. 1), and 26.5 miles of the South Fork of the New River were also included in the system that year.

F. North Carolina Natural Heritage Program

The State of North Carolina through its Department of Natural and Economic Resources, on April 1, 1976 entered into a contract with The Nature Conservancy to develop an inventory and protection plan for the elements of the natural diversity of the state. The contract identifies the program as a means to "provide a systematic basis for identifying ecologically significant areas, communities, species or features; to design a system to protect such areas from adverse impacts; and to help the state develop an overall system to coordinate the process of ecological inventory, systematic data management and analysis and protection."

The initial phase of the program will function until October 1977, when the state will determine if the program should continue. There are presently three Conservancy employees — a program coordinator and two research specialists — and a secretary working on the program under a budget of \$120,000 for 1976; \$60,000 was made available through two private North Carolina foundations and \$60,000 in matching funds was provided by the federal Bureau of Outdoor Recreation.

G. Natural Areas Advisory Committee

This Committee was formed upon request of the Secretary of the Department of Natural and Economic Resources in 1974, to assist the Department in identifying outstanding aquatic and terrestrial natural areas in the state. These sites will be evaluated and possibly recommended for inclusion in a comprehensive natural areas system. The nine-member Committee is also responsible for providing advice on the preservation, management and use of areas for education, recreation and conservation programs.

No areas have been formally designated that have been recommended by the Committee and so far the efforts of the Committee have not been translated into action by the Natural Areas Section of the Division of Parks and Recreation.

H. National Natural Landmarks

The National Natural Landmarks Program within the National Park Service of the Department of the Interior is engaged in designating natural areas which are of national significance. Areas already under National Park Service authority are not eligible, but all other areas within the United States are. Designation takes the form of entry on the National Register of Natural Landmarks. The program was administratively created. The objective is:

...to assist in the preservation of a variety of significant natural areas which, when considered together, will illustrate the diversity of the country's natural history....Natural landmark registration is voluntary and does not change ownership.

Inclusion in the national registry is intended to (1) encourage the preservation of sites illustrating the geological and ecological character of the United States, (2) enhance the educational and scientific value of sites thus preserved, (3) strengthen cultural appreciation of natural history, and (4) foster a wider interest and concern in the conservation of the Nation's natural heritage. (Federal Register, Vol. 40, No. 87, Monday, May 5, 1975, at p. 19504.)

The ownership of any Landmark may be a combination of state, federal, municipal and private.

National Natural Landmarks in North Carolina include Mount Mitchell State Park, Mount Jefferson State Park, Stone Mountain State Park, Piedmont Beech Natural Area in Umstead State Park, Pilot Mountain State Park, Jockey's Ridge State Park and Nags Head Woods, and the Green Swamp. Several dozen other natural areas have been nominated by "theme" studies and are currently under examination for inclusion on the register.

I. Wetlands Protection Act

This 1969 Act establishes a requirement for a permit from the Division of Marine Fisheries of the Department of Natural and Economic Resources before dredging or filling can take place in any estuarine waters, tidelands, marshes or state-owned lakes. The permit will not be issued if the Division finds a significant adverse effect of the proposed dredging and filling on the public's use of water, or the value and enjoyment of the property, on public health, safety and welfare, on the conservation of public and private water supplies or on wildlife, fresh water, estuarine or marine fisheries (NCGS, ss. 113-229, et seq.)

From 1971 through 1975, approximately 1,570 applications for permits were received, and 1,291 permits were issued.

J. North Carolina Environmental Bill of Rights

In the General Election of November 7, 1972, North Carolinians expressed their concern for environmental quality planning by ratifying this Bill as an amendment to the Constitution of North Carolina.

The amendment reads:

ARTICLE XIV, Section 5. Conservation of Natural Resources. It shall be the policy of this State to conserve and protect its lands and waters for the benefit of all its citizenry, and to this end it shall be a proper function of the State of North Carolina and its political subdivisions to acquire and preserve park, recreational and scenic areas, to control and limit the pollution of our air and water, to control excessive noise, and in every other appropriate way to preserve as a part of the common heritage of this State its forests, wetlands, estuaries, beaches, historical sites, open lands, and places of beauty.

The amendment authorizes the state and local governments to acquire properties or interest in properties which will then become part of the "State Nature and Historic Preserves" when accepted by legislative resolution. This provision became effective July 1, 1973.

K. State Nature and Historic Preserve Dedication Act

This 1973 Act of the General Assembly prescribes the conditions and procedures under which properties may be dedicated as State Nature and Historic Preserves. Areas are dedicated to conserve and protect them for the benefit of citizenry pursuant to the North Carolina Environmental Bill of Rights.

The Department of Natural and Economic Resources makes recommendations on what areas need to be preserved. Their dedication requires a two-thirds vote of the General Assembly; then areas are administered by the specific agency under whose jurisdiction they fall.

Since 1973, no new sites have been dedicated for preservation under the Act. There are several state sites and parks included under the system.

L. North Carolina Land Conservancy Corporation

This statute, ratified on April 12, 1974, establishes the North Carolina Land Conservancy Corporation which is empowered to purchase lands that are in their natural unaltered condition. The General Assembly views such lands as of value to the citizens of North Carolina as sources

of recreation and solitude and as reminders of the natural and cultural heritage of North Carolina. The legislation is designed to provide maximum flexibility in land acquisition by the state. This may be done through purchase, conveyance, mortgage, or lease of any interest in real estate, including, but not limited to, fee simple interest.

A ten-member Board of Trustees shall be appointed to act as an administrative body over the Corporation.

While this Act has a strong potential in establishing a system of state-owned natural areas, the Board of Trustees has never been appointed, and therefore no natural areas have been acquired.

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Tools for the Protection of Natural Diversity

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Tools for the Protection of Natural Diversity

I. Introduction

There is no single way to protect elements of natural diversity. Each technique one might employ has its limitations. Acquisition in fee simple, for example, of a property supporting a particular element of diversity -- once widely considered to be a protective mechanism without substantial drawbacks -- is in fact subject to considerable limitations. If the acquisition is by a public agency, that agency may have no special preservation mandate and may convert the property to uses inconsistent with preservation. Even if the agency has a preservation mandate, it may be forced on occasion to yield to others with a stronger mandate. Beyond these problems, acquisition suffers from the disadvantage -- which applies to private conservation organizations as well as public agencies -- that it is expensive. Indeed, it is doubly expensive: initially and in the long run, if adequate stewardship is provided.

A mix of tools is necessary if the protection of natural diversity is to be maximized. Each preservation goal should be pursued by the most appropriate and, given the limited resources under which such programs always operate, the most cost-effective tool available.

What follows is a list and a critical discussion of the tools which appear to be available for incorporation by the State of North Carolina into an efficacious plan for the maximum protection of natural areas. This critical analysis of protection techniques extends the traditional concepts of preservation devices to include other innovative methods, which are administratively viable and politically acceptable. The traditional means for protecting lands that support natural diversity -- by police power regulations, tax incentives, or public acquisition -- have generally proven deficient for a combination of economic, political, administrative, and constitutional reasons. An expanded protection program using interrelated techniques is needed.

The entire protection program, of course, is based upon the premise that an inventory of the elements of natural diversity is underway in the State. Without such an inventory, it is not possible to set the sort of priorities and to match them with appropriate tools which a good protection plan requires.

A program for protection of natural diversity should be based on the principles: (1) to preserve significant natural areas supporting elements of natural diversity identified by a thorough evaluation process; (2) to protect natural areas that will remain under private ownership and control; (3) to honor the constitutional rights of landowners who should be guarded from confiscatory measures and should be fairly compensated for reduced property values; (4) to equitably distribute the cost of the program among those who benefit. Such a program to preserve North Carolina's natural heritage must be founded on the public's growing perception of the value of protecting our natural diversity.

II. Notification

All occurrences of elements of natural diversity technically have an owner. This is obvious when one is considering an occurrence of a special plant species, plant community, or geologic feature, but in other contexts it may be confusing. Although the sighting of an endangered animal species, for example, is sometimes spoken of as an occurrence of an element of diversity, the concept of an element occurrence is confined for technical reasons to the habitat (or portions of the habitat) supporting such species. All element occurrences are in fact property of some sort, and all property is owned. In many cases, of course, the owner may be the public, in the form of a state or the federal government.

One tool for protecting elements of diversity¹ is notification of the owner of the element.² "Notification" means here the act of conveying to the appropriate party at least two things: (1) the fact that the property has been identified through an inventory process as an element of natural diversity; and (2) the nature of the element and its particular value. Additional information about the concept of natural diversity itself and the need to protect it may also be included.

There are many ways this notification might take place. Indeed, those familiar with this tool are convinced that the manner of notification is vital to its success as a protection device, though other factors — judging the receptivity of the party notified and the time at which notification occurs — are also extremely important. It is generally thought that the more bureaucratic the form of notification, the less effective it will be. The National Natural Landmarks Program sends a letter to owners of areas identified as Landmarks and would probably claim some success, but in general informal notification in person (preferably by a peer of the owner) is considered more effective. This is because many owners of ecologically significant areas are unaware of the ecological significance and appear on the whole to enjoy having special characteristics of the land they own pointed out to them in a friendly manner. Another principal which may be of some assistance is that the effectiveness of the notification is likely to vary in proportion as there is a degree of threat to the area, particularly if the owner stands to gain. That is, notification a month before the owner is about to reap a huge gain by selling to a developer is likely to be a lot less effective than notification where no threat is in the offing at all.

Nonetheless, it is almost impossible to generalize meaningfully here. There appear to be success stories — individuals who when informed of some special characteristic of their land took extraordinary precautionary measures — and horror stories — individuals who callously

¹For convenience we will speak of protecting the elements themselves rather than their occurrences.

²In some cases it may be more appropriate to notify the caretaker or some other person or agency more immediately involved in what happens to the property than the owner.

bulldozed exceedingly important areas in order to destroy any problems with marketability that might follow from possessing an element of natural diversity. Good judgment in notification, with attention to the peculiarities of the particular case at hand, is the best that can be expected.

Notification is relatively inexpensive compared to other tools available. The most expensive version would probably be a personal visit where informative materials are prepared and supplied to the owner.

The strength and effectiveness of notification, in so far as it can be meaningfully determined in general, is, on the low end of the spectrum. If notification is the only protection for an element of diversity, the destruction of that element depends only upon the strength of the owner's determination to protect it. As has been said, there may be cases where this strength is remarkable, but over a wide range of cases it is not as strong as other protection methods.

Authority - No State statutes specifically authorize a notification program, yet conveyance of such information to the owner of an occurrence of natural diversity could be construed as a legitimate service of the State.¹

Application - The Natural Heritage Program can prepare and update a list of occurrences of elements of natural diversity which are of particular value. The list should be reviewed by the Department of Natural and Economic Resources' Natural Areas Advisory Committee, before notification is made in a manner determined by the Department Secretary. Notification can be made in a variety of ways. Staff of the Natural Heritage Program should take a principal role in the notification process, perhaps in conjunction with the land information service of the North Carolina Land Policy Council. The exact process and procedures must be determined by common agreement among agencies concerned with natural areas.

III. Registration or Designation²

It is hard to imagine notification taking place without some sort of list of elements of natural diversity to work from. Indeed, the present analysis is based on the premise that an inventory of elements is underway, and the fruits of an inventory are things which can be listed.

¹An opinion of the Attorney General will be necessary to clarify this point.

²The term "designation" is the most ambiguous of the terms in use in protection planning for natural areas. In some statutes and literature it is used to mean a form of notification; in others it means dedication. Here it is used to mean placing an element on a registry or list.

A registry may be thought of as a formal list. What constitutes "formality" and the degree of formality may vary from state to state. The registry may be mandated by a statute, with prescribed procedures for making entries, or it may be an administrative tool created by administrators of a program with a broad mandate and used according to procedures which have never been published.

Examples of registries abound. A prominent registry in the field of historic preservation is the National Register of Historic Places, housed in and maintained by the Office of History of the National Park Service in the Department of Interior. The natural history counterpart of this, although it is administratively rather than statutorily created, is the National Register of Natural Landmarks. The listing of a feature or area on the National Registry comes as the final result of the following process. First, a site may be considered for landmark designation whether it is in private or public ownership; suggestions that a site be considered may come from any source. After an initial weeding out based on natural history "theme studies," promising sites are subjected to investigation by qualified individuals. Evaluation reports based on the investigation are reviewed by staff and selected sites are proposed to the Advisory Board on National Parks, Historic Sites, Buildings and Monuments.

If the board recommends to the Secretary of the Interior that a site qualifies for natural landmark designation, the Secretary may accept the recommendation and publicly announce eligibility for designation, though this amounts in fact to the creation of "natural landmark status" for the site, so that the site appears on the Registry. At the same time a letter is sent to the site owner inviting him to sign an enclosed agreement to commit himself to preserve the site's natural values. When the signed letter is received in the Washington Office that fact is noted on the Registry, and an appropriate certificate and a plaque are sent to the owner. The agreement between the owner and the Secretary may be terminated by either party upon notification. Termination removes the site from the Registry, and the owner is to return the certificate and remove the plaque from display.

Given an ongoing inventory, the cost of preparing and publishing an official registry is, like that of notification, quite low.

The legal protection afforded to natural areas by a registry like that of the natural landmarks is substantially less than the strong protection afforded by systems of dedication, discussed below. The protection afforded is in fact nothing more than the official recognition registration accords the site and environmental analysis requirements where appropriate.

The protection provided by a registry must not, however, be underestimated. The singling out of an area because of certain virtues calls what otherwise might be an unnoticed and disregarded site to public attention and facilitates the sanctions that public opinion may exert should the owner seek to destroy these virtues. The act of recognition may also affect the owner more directly, and here it overlaps

the notification tool. The owner may possibly be reluctant to convert the site to a use which would deprive his property of official recognition.

One final characteristic of the registration tool must be mentioned. It is not necessary that the designation afforded by the registry be something voluntarily received by the owner of the site or the element. The Natural Landmarks Program outlined above does provide for an agreement letter, and this probably has helped further the purposes of the program by actively involving the property owner in the appreciation of the natural significance of his land. But whether or not the owner signs, the landmark is listed on the registry; it is thus perfectly possible to use the registry where the owner does not wish to have the site or element registered. The National Registry of Historic Places has the most experience in this type of situation. We are advised by counsel at the Registry that the placing of certain historical buildings and sites on the registry has in a few cases resulted in litigation, the property owner claiming, among other things, that registration amounts to an unconstitutional taking of his property since it makes the property more difficult to sell for development purposes. This taking claim is generally without merit.¹

Two variations on the registration method might be considered for those property owners who are willing to make some commitment to assist in the preservation of the natural elements on their property but who do not wish to donate or sell any of their property rights. One possible approach would be an official recognition. A second option would be a type of pledge program that would provide more incentive for continued protection of the natural elements of recognized importance.

A. Recognition Program²

A Natural Areas Recognition Program would be based upon an official list of significant natural areas derived from the Natural Heritage Program's inventory of occurrences of elements of natural diversity. The formal list of natural areas would be prepared by the staff of the Natural Heritage Program, with review and advice from the Department of Natural and Economic Resources' Natural Areas Advisory Committee (composed of knowledgeable botanists, zoologists, ecologists, earth scientists and executive officers of conservation organizations), and would be approved by the Department Secretary. The Natural Areas Recognition Program would then (1) offer the owner of the natural area the option of having the affected portion of his property officially

¹But see, *Lutheran Church v. City of N.Y.*, 359 N.Y.S. 2d 7 (Ct. of appeals 1974). For a general discussion, see The Taking Issue (CEQ, 1973).

²This technique is suggested for consideration and discussion and is not a formal proposal.

recognized in return for signing a non-binding agreement (promise) to manage the site for the protection of the element(s) of natural diversity, and (2) present the owner with an official plaque or certificate which indicates the area is a North Carolina Natural Area. The agreement would involve no payment of funds, tax exemptions, etc. The owner would have the option to cancel at any time. The State would rescind recognition if the owner failed to carry out the promised management practices. The landowner could request management advice from the Natural Heritage Program staff or Department's Natural Areas Advisory Committee. The agreement would provide no right of public access, although arrangements for access could be made by persons pursuing scientific or educational purposes after receiving permission of the landowner.

Viability - The Recognition Program approach to preserving elements of natural diversity is intentionally low-key. Its implementation would involve a relatively small amount of funding and constitutes the lowest level of government interference in the affairs of private landowners. While the level of protection afforded by such a program is decidedly low and impermanent, similar programs in England and Wisconsin have been successful.¹

Authority - No one of the North Carolina's State agencies appears to have a sufficiently broad mandate to begin such a Recognition Program by administrative initiative without specific legislative authorization.

Applications - The Recognition Program should be presented to a private landowner as one of several options at the time he is notified about the presence of unique elements of natural diversity on his property. This should probably be the first option presented, as it is least likely to elicit unfavorable reactions. Other options to be suggested are described below.

B. Pledge Program

A Natural Area Pledge Program would constitute a level of protection above that afforded by a Recognition Program and would carry a more significant degree of government involvement in private landowners' affairs. It would essentially go a step beyond recognition by affording the landowner a preferential property tax assessment for agreeing to manage the affected portion of his property in accordance with procedures outlined by the State. The approach is similar to that already in effect in North Carolina for agricultural and timber lands (see section below on tax incentives). Two approaches are possible here. Under the first, the landowner could cancel the agreement at any time but would be required to pay a penalty fee of rollback taxes. The extent of the penalty should be greater than that currently assessed for changes in the agriculture or timber

¹The Nature Conservancy, The Preservation of Natural Diversity (1975).

land preferential assessment agreement, since these are not large enough to deter development under frequently encountered market conditions.¹ A second approach would be to negotiate a renewable agreement over a specified period of time, again with preferential tax assessment provisions designed to prevent creation of a tax shelter.² Plaques or certificates would be issued under the Pledge Program. Management advice from the Natural Heritage Program staff or Department's Natural Areas Advisory Committee would be available as under the Recognition Program.

Viability - As will be discussed in the section on tax incentives (below), programs of preferential tax assessment in and of themselves have not been particularly successful in preserving rural lands. However, the psychological benefit of recognition of a site as a unique North Carolina natural area, coupled with tax benefits for protection and rollback tax penalties for breaking the arrangement, should make this option a stronger method of natural area protection than the Recognition Program alone. A problem will be the possible objections from county officials who do not wish to see reduced property taxes; they will have to be persuaded by the importance of protecting significant natural areas and by other compensations (see tax incentive section below).

Authority - New legislation would be required to permit such a Pledge Program.

Application - A Pledge Program would provide a tax incentive to the private landowner who does not wish to permanently relinquish any property rights. NCGS 105-275 already provides such tax relief for non-profit organizations.

IV. Police Power Regulations

The police power is the power of the state to "...[promote] the public welfare by restraining and regulating the use of liberty and property."³ It is the recognized power of the state to promote the health, safety, and welfare of the public. Attempts to use police power regulations to control the patterns and quality of land use typically have been restricted to zoning, subdivision ordinances, and building permits.

¹Council on Environmental Quality, Untaxing Open Space, An Evaluation of the Effectiveness of Differential Assessment of Farms and Open Space (Washington, D.C. CEQ, 1976).

Henke, Preferential Property Tax Treatment for Farmland, 53 Ore. L. Rev. 117 (1974).

²Dean, "A Panacea That Wasn't: The Williamson Act Needs Repair," Cry California, Summer, 1975.

Comment, 13 Santa Clara Law, 284(1973).

³E. Freund, The Police Power, iii (1904).

Zoning is the most prevalent form of such "police power" regulations applicable to natural land preservation. Zoning as a means of segregating and specifying particular land uses, however, has been ineffective in preserving environmentally important land. Although zoning per se has inherent problems as a means of land use control, these problems are often exacerbated by poor administration of zoning. The potential of police power regulations for natural land preservation is limited by the short-sighted administration characteristics of most local governments authorized to use zoning.

Zoning has other shortcomings. Under prevalent legal and societal concepts of property rights, conventional zoning can too easily amount to an invalid "taking" of property without compensation. To avoid this dilemma, authors and administrators of zoning regulations should justify their choice of particular zoning regulations by basing the regulations on the natural conditions of the land and the public needs. A line of recent court decisions in several states has accepted restrictive land use regulations to preserve ecologically sensitive areas.¹ This trend indicates a new relationship between property rights and the public interest.

Regulatory powers exercised by regional governing boards with review by state agencies may better control land resources of areawide importance. The North Carolina Coastal Area Management Act provides authority to regulate development in "areas of environmental concern" to be identified in the twenty coastal counties. These areas can include complex natural areas, habitats of remnant species, and unique geologic features.² The NC Land Policy Council has considered eventual statewide expansion of the process of regulating areas of environmental concern, but is not yet proposing statewide adoption.³ There are many unresolved legal issues and administrative problems in this management technique,⁴ but the capacity to review development in areas of environmental concern and to deny a permit when that development is inconsistent with state guidelines or local land use plans is a potentially powerful tool.

¹E.g., *Candlestick Properties, Inc. v. San Francisco Bay Conserv. & Dev. Comm'n*, 11 Cal. App. 3d 557, 89 Cal. Rptr. 897 (Ct.App.1970); *In re Spring Valley Dev.*, 300 A.2d 736 (Me. 1973); *Just v. Marinette County*, 56 Wis. 2d 7, (1972).

²NCGS 113A-128(1974); *Coastal Resources Commission Guidelines* (1976); Thomas J. Schoenbaum "The Management of Land and Water Use in the Coastal Zone; A New Law Is Enacted in North Carolina," 53 *North Carolina L. R.* 275 (1974).

³NC Land Policy Council, *Criteria for the Identification of Areas of Environmental Concern*, July 1974; NC Land Policy Council, *A Land Policy Program for North Carolina*, 1976.

⁴Peter Glenn, "The Coastal Area Management Act in the Courts: A Preliminary Analysis," 53 *North Carolina L. R.* 303 (1974).

Thomas J. Schoenbaum and Ronald H. Rosenberg "The Legal Implementation of Coastal Zone Management: The North Carolina Model" *Duke Law Journal* 1 (1976).

Police power regulations, particularly more innovative forms of zoning, can be used successfully in combination with other techniques to protect natural lands. But few governments have actually adopted such innovative forms of zoning as impact (performance) zoning, incentive zoning, or planned unit development zoning. Even when effectively and innovatively used, police power regulations alone are inadequate methods for preserving important natural lands.

V. Less-Than-Fee Acquisition¹

Property is often said to consist of a bundle of rights. It is possible to purchase (or otherwise acquire) some of these rights from the owner rather than the entire bundle, and often it is much less expensive to do so. It is frequently possible to obtain protection of an element of natural diversity simply by acquiring the rights of the owner which would be inconsistent with protection of that element (e.g., the right to develop the property).

Although a variety of legal devices may be used to achieve this sort of less-than-fee acquisition, the primary tool at issue here is the conservation easement.² (Conservation easements are called conservation or scenic "restrictions," "covenants," "futures," and "agreements" in certain jurisdictions.)

In essence, conservation easements are restrictions which landowners place on the property voluntarily or for monetary consideration, and which are legally binding on the present and future owners. When the owner places a conservation easement on his land, he gives up certain rights specified in the easement document. As a matter of form, the rights are transferred to a recipient (such as a conservation organization or governmental body) in a legal document. When the document is properly drawn, signed and recorded, the owner and future owners of the property can no longer exercise those rights given up in the easement document.

The easement holder has the right to ensure that the restrictions placed on the land are observed. The easement does not allow the public access to the land unless that is specifically provided for in the easement document. The document generally does not give the easement holder the right to do any of the things which the landowner is prohibited from doing on the land.

¹See Peacock and Roe, "The Present and long-Range Potentials of Conservation Easements To Protect North Carolina's Natural Heritage," April 1976, prepared for the NC Div. State Parks & Recreation.

Peacock and Roe, "Conservation Easements: To Preserve North Carolina's Heritage," handbook for property owners published under multiple sponsorship, April 1977.

Roe, "Innovative Techniques To Preserve Rural Land Resources," Environmental Affairs, Boston College Law School, 5:419-446, summer 1976.

²Some others: reversionary interests; restrictive covenants; options. Purchase of a percent of the fee, often useful in stopping private developers (they generally require complete possession of all interests in an area before they can go ahead), is for the present analysis considered a form of fee acquisition.

The owner of the property (the fee interest therein) retains all other rights which inhere in ownership. Unless the easement document provides otherwise, the owner can, for example, sell the property, live on it, or bequeath it; conversely, he still must pay taxes on it.

A conservation easement is flexible and can be written to include almost any kind of restricted use agreed to by the owner and the easement holder. It can provide that the land be left completely in its natural state or it can provide for various activities, such as hunting and fishing. The easement may apply to the entire property or only to a portion of it -- for example, a wooded or swampy area or a shoreline.

The advantage of the conservation easement as a protection tool is the low cost compared to full fee acquisition. It possesses many of the protective strengths of full fee acquisition of property, but involves only a portion of what that acquisition would cost.

Despite this, easements are infrequently used due to confusion surrounding their legal status, a general lack of familiarity with them, and an absence of solutions to many of the practical problems associated with them. In many cases, because of uncertain state laws, it is technically easier to buy land outright than it is to acquire only those rights which would insure that the land remains unchanged. Most private landowners must, moreover, be educated on the subject of conservation easements in order to understand how the granting of such an easement would affect their rights and the future use of the land. In addition, appraisal methods as they are applied to conservation easements have yet to be standardized.

When a conservation easement is granted, the easement holder must assume a watchdog role in cooperation with the landowner. Therefore, the management responsibilities are diffused and monitoring problems peculiar to such easements arise. For example, although specific conservation restrictions are formulated at the time that the easement document is executed, conflicts and confusion may occur in interpreting what land use restrictions permit and do not permit. Furthermore, since most easements have been granted recently, the most troublesome problem of monitoring conservation easements may not yet have surfaced. At the time that an easement is granted, the holder may enjoy a satisfactory relationship with the landowner. However, the relationship may deteriorate as ownership of the land passes to successors in title. Because the land is permanently encumbered, easement restrictions must be reviewed with each successive landowner to insure continued compliance with the terms of the easement.

Viability - The tool of conservation easements is an attractive alternative for protecting important natural areas. Conservation easements can permanently prevent misuse of land, while leaving land in productive private ownership. Even so, as described above, there are certain problems that must be considered in undertaking a program of less-than-fee acquisition. Acquisition of interests in land will require a funding commitment by the state for purchase, administration, and monitoring. Donations of conservation easements can be expected

because of the advantages to landowners sensitive to the natural values of their property. But any forced acquisition or proposed use of the power of eminent domain or condemnation of development rights, in order to protect natural areas, would be a source of controversy. Opposition might also arise from local governments' fears about reduced property tax revenue, which must be allayed by persuasion or compensation.

Authority - Acquisition of less-than-fee interests in North Carolina is authorized to support "open space" conservation and recreation programs which would include natural areas.¹ The State of North Carolina is empowered also by constitutional amendment to acquire interests in property for the preservation of important elements of North Carolina's natural and historical heritage.² North Carolina counties and municipalities are authorized to accept gifts of easements "in order to preserve, through limitation of their future use, open spaces and areas for public use and enjoyment."³ The term "open space" is broadly defined to include natural areas.⁴

It thus appears that conservation easements may be acquired by the State for the protection of certain lands which are important for their natural and cultural values. Yet, new legislation specifically written to protect North Carolina's natural diversity is needed to declare the protection of natural areas to be a public purpose and to clarify legal questions regarding enforcement of easements, later ability to amend or modify easements, and perpetuity of easements.⁵

General tax laws indicate that property tax relief is available for land encumbered by easements, even in the absence of specific tax provisions in existing statutes authorizing easement acquisition. If the conveyance of a conservation easement lowers the value of the underlying estate, the reduction must be taken into account in appraising the property for taxation.⁶

Application - Conservation easements are now a practicable tool for protecting natural areas. With more specific legislation, such less-than-fee acquisition could be a most useful preservation technique.

¹NCGS 160A-401 et. seq.; NCGS 113A-123 (c); NCGS 113A-38; NCGS 113A-76; NCGS 113A-90.

²Article XIV, Sec. 5, 1972.

³NCGS 160A-401 et. seq.

⁴NCGS 160A-402.

⁵See Peacock and Roe, "The Present and Long-Range Potentials of Conservation Easements to Protect North Carolina's Natural Heritage," April 1976.

⁶NCGS 105-317(a)(1)

William A. Campbell, "Conservation Easements," Popular Government, NC Institute of Government, April 1973, 36-38.

VI. Fee Acquisition

An obvious protection device is to buy the property in question. Here we are speaking of purchase of the property in fee simple -- the entire bundle of rights that comes with the maximum degree of ownership permitted in the jurisdiction in which the property is located.

There is no need to explain the merits of acquisition as a means for achieving the protection of the elements of natural diversity. The important point about this tool, however, is that it should not be thought that an element acquired is an element saved. On the contrary, many elements of natural diversity exist on land which is in public ownership, and it is precisely because of public ownership that an element is threatened: for the agency which owns the property may be the very agency which is about to exploit it. Alternatively, that agency may be powerless to prevent other agencies from proceeding with projects which would destroy the element.

Even where the ownership rests in a private conservation organization, there is no necessary connection between acquisition and protection. There are stewardship burdens which may be impossible to meet; these are discussed below. The conservation organization may be unable to prevent certain governmental actions which would destroy, or at least harm, the element. A public utility may wish to put a transmission line through the property. The highway department may desire a highway which would destroy the habitat of an endangered species. The state may fail to grant property tax exemption on the parcel acquired, making it prohibitively expensive to retain. Private development surrounding the area of the element may occur in a fashion and to a degree that it is severely detrimental to the element. A federal agency, such as the Army Corps of Engineers, may want to construct a dam which would inundate the area. (These examples all reflect real cases.)

Beyond this it should be emphasized that money used for acquisition constitutes only an initial investment in preservation. The Nature Conservancy, which has actively pursued the preservation of natural areas using a fee acquisition approach, has found that there are innumerable problems and responsibilities attendant upon ownership of a tract of natural land. Purchase merely marks the beginning of a long relationship with the land which involves various forms of maintenance and protection and the commitment of additional money and human resources. Indeed, in a severe case it may well be that the burdens of stewardship become too onerous, that a particular parcel of property cannot be protected because it would be so expensive to do so that the organization would have to sacrifice other more important protection goals.

Authority - Although the State's purchase of unique natural areas is not specifically authorized by statute, the State is broadly authorized to acquire lands necessary for public parks and forestry purposes.¹

¹NCGS 146-22.

The Department of Natural and Economic Resources can purchase lands as State forests for experimental, demonstration, educational, park, and protection purposes.¹ The Department is authorized to accept gifts, donations, or contributions of land suitable for forestry or park purposes.² DNER's land purchases must be paid by appropriated funds or available unappropriated revenues of the Department, including federal grants, when such acquisition is approved by the Governor and the Council of State.³

By constitutional amendment (Article XIV, Sec. 5) the State and its political subdivisions are enabled to acquire and preserve park, recreational, and scenic areas, in order to conserve and protect the State's natural and historic resources for the benefit of its citizenry. The amendment goes on to establish a system of "State Nature and Historic Preserves," to include properties approved by three-fifths of the General Assembly.

Application - Outright state ownership should always be seen as one of several possible protection techniques. Because of the expense and problems and because the maintenance of natural lands in private ownership is an important social goal, fee simple acquisition should not necessarily be the first choice even where feasible.

VII. Dedication

It is possible to greatly increase the degree of protection afforded by ownership of the fee or a lesser interest. In many states a process exists, one created by statute, whereby the owner of an appropriate interest in property (generally the fee) may dedicate that interest. It is characteristic of this process that the owner retains the interest dedicated, so that a fee owner who dedicates his property need not divest himself of his title.

The dedication is usually made in conjunction with a public conservation agency. The dedication may be the voluntary act of a private owner, with no money involved, or the public conservation agency may pay out funds necessary to achieve dedication. Alternatively, the dedication may be the act of another public agency seeking to achieve for its lands the benefit that dedication bestows. The effect of dedication is that the fate of the property dedicated is determined by the dedication agreement (articles of dedication) and by the statute creating the dedication process.

Under most such statutes articles of dedication are executed by the owner of the land in the same manner and with the same effect as a conveyance of an interest in land and are irrevocable except as provided in the statute. The county recorder may not accept articles of dedication for recording unless they contain terms restricting the

¹NCGS 113-34.

²NCGS 113-40.

³NCGS 113-8.

use of the land which adequately provide for its preservation and protection against modification or encroachment resulting from occupation, development, or other use which would destroy its natural condition. Articles of dedication may contain provisions for the management, custody and transfer of land, provisions defining the respective rights of the owner or operating agency and the recipient, and such other provisions as may be necessary or advisable to carry out the uses and purposes for which the land is dedicated. They may contain conditions under which the owner and the recipient agency may agree to rescind the articles.

The primary statutory protection that dedication provides is two-fold. First, the owner (or some other designated party, such as the conservation agency) is bound to preserve the property dedicated in its natural condition. Second, a high standard is raised against condemnation of the property. Typically this standard states that dedicated areas:

shall not be taken for any other use except another public use after a finding by the department of the existence of an imperative and unavoidable public necessity for such other public use and with the approval of the Governor. Except as may otherwise be provided in the articles of dedication, the department may grant, upon such terms and conditions as it may determine, an estate, interest or right in, or dispose of, a nature preserve, but only after a finding by the department of the existence of an imperative and unavoidable public necessity for such grant or disposition and with the approval of the Governor.

This particular standard is taken directly from section 1517.06 of the Ohio statute on dedicated natural areas (Ohio Rev. Code, ch. 1517). Other states often add to this standard the declaration that a dedicated area is at its "highest and best use." In all cases a public hearing is provided for before the required findings may be made.

The cost (excluding stewardship, the main responsibility for which is often retained by the owner of the fee) of dedication is quite low in most cases. Unless something is paid out to induce the dedication, the only costs are those of preparing the articles of dedication and having them recorded. This, of course, does not include costs of passing a dedication statute or making findings under it.

The protection afforded is quite high. It greatly exceeds the protection of fee ownership where that ownership is by a public agency which does not have the benefit of the standard of "imperative and unavoidable public necessity." It also exceeds the protection of fee ownership by a private conservation organization; unless the organization dedicates the property, it will not have the benefit of the "imperative and unavoidable public necessity" standard.

Viability - Dedication increases the degree of protection for elements of natural diversity, and with few additional costs. The cost

of monitoring and stewardship should be considered before undertaking a dedication program, but should be seen as guaranteeing the greatest degree of protection.

Authority - New legislation providing articles of dedication would be necessary. Authority for dedication of "Nature Preserves" and mechanisms for so doing are already provided in Article XIV, Sec. 5 of the North Carolina Constitution and in the State Nature and Historic Preserve Dedication Act of 1973.¹ The current procedures require a two-thirds vote of the General Assembly for inclusion of an area as a State Nature or Historic Preserve. The Act does contain a clause which states that the act "shall not preclude the dedication of properties by other means for purposes identical or similar to those enumerated by Article XIV, Sec. 5 of the North Carolina Constitution." Thus, the Constitutional amendment appears to provide the authority for legislation that would provide a viable dedication program.

VIII. Trust dedication

"Trust dedication" is used here to mean the same tool as that previously described, with one important difference. In this case a statutory trust is created and is to be administered by a designated agency. The standard for permitting a change in the use of the property -- from a preserved area to, say, a dam's reservoir -- is the same ("imperative and unavoidable public necessity"), but in this case that decision is not made by the agency with the concurrence of the governor. It is made by a court of equity.

The trust-creating statute may be fashioned in a number of ways. A public hearing may be required, and consent of the agency and the governor may be retained, but the final decision is made by a court. The statute may also provide that in order for property to be placed into the trust, the title must be transferred to a trustee agency. If the statute so requires, then this, of course, is a second point at which ordinary dedication diverges from trust dedication.

The statute in all cases creates a broad but definite set of beneficiaries. To quote the language used in the South Carolina statute:

The beneficiaries of this trust are and shall be the present and future generations of citizens of the State, more particularly those present and future citizens residing within a close proximity to any area or feature which itself, or an interest therein, becomes, constitutes, or comprises a part of the corpus of such trust and who actually enjoy use of such area or feature; and further and more particularly, those present and future students, teachers, and persons residing in the State who are concerned with conservation or with research in any facet of ecology, history or archeology and who actually utilize any such area or feature for the promotion of such interest. (Section 9).

¹NCCGS 143-260.6 to 143-260.9.

The assumption contained in the South Carolina statute, one which could be made explicit in future statutes which intend to incorporate the trust dedication tool, is that these beneficiaries would be the parties-plaintiff before the court in a case where the court must decide whether the property is to remain preserved or is to become a reservoir.

The cost of trust dedication, assuming that title to the property need not be transferred, is very similar to that of dedication proper.

The protection afforded is presumably greater. One must say "presumably" because the device is so new that there have been no cases testing its strength.

One important point must be made about both dedication and trust dedication. Because the protection they afford is so strong, in a number of instances there will be reluctance on the part of many people to foreclose options permanently; it is often falsely believed that half-way measures will be sufficient and that drastic steps are to be avoided.

IX. Tax Incentives

A. Preferential Assessment

Preferential assessment is a technique of assessing land which results in taxation of that land at some lesser rate than its full fair market value. It is well recognized that property taxation of rural land on the basis of its fair market value stimulates conversion and intensive development of that property. North Carolina is among the more than forty states with preferential tax laws adopted to ease the tax burden for farmers and owners of timber land.¹ The rationale underlying these laws is that by reducing tax burdens on such rural land, the rate at which the land will be converted and developed is reduced. Most states use a deferred taxation type of preferential assessment which recovers back taxes (a "rollback penalty") if a change in land use occurs for the property that has been taxed at reduced rates. North Carolina collects rollback taxes for just three years. The "penalty" is usually only a fraction of the profits realized from development.

Viability - Recent analyses conclude that preferential tax laws have not significantly deterred farmland conversion.² Preferential tax assessments provide only weak holding action until speculative desires are satisfied or until stronger restrictions are

¹NCGS 105-277 (1973), amended 1975.

²For example, see, Council on Environmental Quality, Untaxing Open Space, An Evaluation of the Effectiveness of Differential Assessment of Farms and Open Space (Washington, D.C. 1976).

imposed. The Council on Environmental Quality study represents the opinion of most careful observers and analysts:

..... differential assessment laws in general work well to reduce the tax burden on farmers. Acting alone, however, they are not very effective in preserving current uses. It is only when such laws are combined with other effective land use mechanisms in rural areas that they contribute to successful long-term preservation of open lands.¹

Authority - North Carolina preferential assessment provisions (NCGS 105-277.2) extend only to agricultural, horticultural, and commercial forest lands. They do not reduce taxes on unique natural lands. To provide preferential assessment for natural areas, additional legislation is required. However, NCGS 105-275 does exempt from property taxes any "real property owned by a nonprofit organization or association exclusively held and used by its owner for educational and scientific purposes as a protected natural area." (The statute defines "protected natural area" as "a nature reserve or park in which all types of wild nature, flora and fauna, and biotic communities are preserved for observation and study.")

Application - The most effective use of preferential tax assessment for protecting natural areas would be in association with restrictive agreements. Restrictive agreements combine preferential assessments with restrictions on the use of land. Easements or dedications do constitute restrictive agreements that would inhibit a landowner from developing his land.

B. Tax compensation (subsidy)

When limitations on the use of land reduce the market value of land, the issue of compensation becomes paramount. Many of the protection tools described in this report, in certain situations, will reduce the market value of property. In those instances, the property owner may expect compensation either by direct payment or through tax benefits.

Public acquisition of development rights will, if assessors recognize reductions in value to transfer of the right to develop protected areas, reduce the tax base of local governments, which are heavily dependent upon property taxes. It is possible, however, for local governments to recover some or all of what they lose by increasing the assessed values of nearby property, on the theory that property in the vicinity of restricted property benefits from the amenity the restriction created. But where local governments may be hurt by removal of taxable values from large land tracts, a development rights acquisition or restriction program might provide for a statewide revenue fund or pool from which in-lieu-of-tax payments by the State

¹Ibid.

to local governments may be made, in order to avoid inequitable fiscal hardship in a particular locality.¹

A comprehensive program for natural area protection should be prepared to bear the costs for purchase, administration, and enforcement of development rights acquisition or restrictions and for compensation to local governments. The most logical source of financing is the State. When the funds needed for a development rights acquisition program exceed those provided by appropriations or grants, allowance must be made to permit the use of general obligation bonds, a revolving fund, or alternative sources of tax revenues. Examples of special taxation include an increased land transfer tax,² an unearned increment tax on land values,³ or increased capital gains tax on land sales.⁴

Authority - General tax laws of North Carolina indicate that property tax relief is available for land restricted by a conservation easement when the easement lowers the value of the underlying estate.⁵ No statutory authority or compensatory tax provisions exist for dedication of private property to natural values. Provision is not now made for compensating local governments for property taxes lost from restricted properties.

Application - New legislation is needed to specify property tax benefits, provide in-lieu-of-tax compensation for local governments, limit landowner liability, and provide the funding for a comprehensive program for natural diversity preservation.

¹Michigan's Wilderness and Natural Areas Act of 1972, Mich. Stat. Ann. 13-734 (1)-(13), attempts to compensate local governments for tax revenue lost due to "wilderness, wild or natural areas(s)" within their jurisdictions. Federal legislation (1976) provides payment of \$0.75/acre to counties containing public lands, less amounts equal to county receipts from forestry and mineral leases.

²An expanded land transfer tax of 0.4% on all real estate transfers was proposed by a New Jersey committee to finance state purchase of development rights. Gross proceeds at 1971 prices would have been \$22 million. See REPORT OF THE BLUEPRINT COMMISSION OF THE FUTURE OF NEW JERSEY AGRICULTURE (1973).

³McClaughry, "Taxes for Land Acquisition," The People's Land P. 154 (P. Barnes ed. 1975).

⁴Vermont is the first state to enact a capital gains tax on land. VT STAT. ANN. tit. 32, sec. 10001 et. seq. (Supp. 1975).

⁵NCGS 105-317 (a)(1).

X. Environmental Impact Analysis

The National Environmental Policy Act requires environmental impact assessments to be made by federal agencies on their major actions significantly affecting the environment.¹ North Carolina is among the states with similar requirements for state actions.² The NC Environmental Policy Act of 1971³ was never fully implemented or enforced by the State.⁴ The act also permits local governments to require environmental impact statements for "major development projects" proposed in their jurisdictions, but few local governments have used the authorization.⁵ The North Carolina statute is now due to expire after September 1, 1977, unless extended or revised by the General Assembly.

In addition to NEPA and its offspring, there is the A-95 review process. Office of Management and Budget A-95 procedures⁶ require applicants for federal assistance to notify other agencies (through the state clearinghouse) and to provide opportunity to review their proposals in order to eliminate redundancy or conflict.

Although the practice which has evolved since the passage of these statutes and creation of the A-95 review process belies this somewhat, the purpose of impact analysis is protection of the environment — including elements of natural diversity — and not simply paper shuffling. Despite grave reservation, most observers of the process feel it has achieved positive results and the environment would be in far worse condition today were it not for impact analysis.

XI. Other Tools

The following groups of tools should be mentioned, although they are not as readily subjected to analysis as those previously discussed.

Consciousness-Raising. The first group consists of efforts to raise consciousness. Consciousness-raising can be accomplished by increasing generally the awareness in society of the need to protect the elements of natural diversity or it can be done by educating students in the ecological foundations of diversity preservation. This tool can, of course, be used by government as well as by private groups. Its cost is probably directly related to its ambitions. Its protective value is difficult to determine.

¹42 U.S.C. sec. 4321-4347 (1970).

²Council on Environmental Quality 1976 Annual Report.

³NCGS 113A-1 through 113A-20 (1971).

⁴Roe, "The Demise of a State Environmental Policy Act: The North Carolina Environmental Policy Act," UNC-CH Center for Urban and Regional Studies, April 1975.

⁵Roe, "The North Carolina Environmental Policy Act: Neglected Planning Tool," Popular Government, NC Inst. of Government, Fall 1975, 44-48.

⁶Office of Management and Budget, "A-95: What It Is — How It Works" and "Circular A-95."

Fighting Tools. The second group consists of legislative and legal "fighting" tools -- lobbying and environmental lawsuits. These are basically the preserve of the private conservation movement, but it would be possible to institutionalize them to some degree through a staff of publically supported ombudsmen. The protective value of these tools is probably high, although it varies substantially from case to case; the cost is also high.

Watchdogging. Often groups are formed for the specific purpose of keeping tabs on a specific portion of the landscape. Barrier islands, for example, are beginning to be monitored on a semisystematic basis. Wetlands and wilderness are other categories which such groups have chosen to report on regularly.

Preliminary Draft: A Bill to Create a North Carolina
Natural Heritage Preserve System*

The previous two studies set out the variety of protective techniques available to North Carolina to protect its natural heritage and describe the institutional framework which presently exists for accomplishing this purpose. The following proposal recommends how the tools may be brought together within the framework and whether any administrative or legislative changes are required for an effective program.

One of the first things to note in making these recommendations is how different North Carolina appears to be from other states where the Conservancy has made such recommendations. In most of these states there was virtually a clean slate on which to write. There was no provision in the state constitution declaring it to be the policy of the state to conserve and protect its lands and waters as a part of the common heritage of the state. There was no legislative provision creating a dedication system of any sort to bring strong legal protection to bear on ecologically significant areas. There was no Land Conservancy Corporation set up to purchase natural areas and interests therein. There was not even a statute putting conservation easements, potentially an extremely useful tool, on a firm legal foundation.

That these provisions and programs do exist in North Carolina would appear to be a great advantage. In fact, our view is that it is a disadvantage. Close inspection of these North Carolina provisions and programs reveal that they are basically either dead in the water or listing dangerously either to starboard or to port. The result is that a clear channel for natural diversity protection does not exist at present and any new effort may be in effect blockaded.

...

The problem extends to the very top, to the constitutional provision that is generally known as the North Carolina Environmental Bill of Rights. It will be remembered that this provides that:

ARTICLE XIV, Section 5. Conservation of Natural Resources.

It shall be the policy of this State to conserve and protect its lands and waters for the benefit of all its citizenry, and to this end it shall be a proper function of the State of North Carolina and its political subdivisions to acquire and preserve park, recreational and scenic areas, to control and limit the pollution of our air and water, to control excessive noise, and in every other appropriate way to preserve as a part of the common heritage of this State its forests, wetlands, estuaries, beaches, historical sites, open lands, and places of beauty.

*Hardy L. Wieting, Legal Advisor, The Nature Conservancy.

This seemingly unimpeachable provision in fact suffers from a failure to offer meaningful guidance as to which lands and waters — which parts of "the common heritage of this State" — are to be preserved. Obviously, not all forests, wetlands, etc., can be preserved, so the vital question is how to pick and choose.

The necessary guidance could be provided by the state in two ways. Either the constitutional provision itself should be changed or a statute passed under the authority of the existing provision which clearly makes protection of elements of natural diversity a principal goal of the state. This is the primary way to protect the common heritage of the state and to avoid the implication that all forests, wetlands, etc., are to be protected. Other goals and values should of course not be neglected. The concern for controlling air, water, and noise pollution is not in question here. The amenity value of many parks and recreation areas is something which should, and can, be pursued in conjunction with the goal of diversity protection. But the missing component in the state's highest level policy statement is clarity on the point that it is occurrences of the elements of natural diversity of the state — the full range of such occurrences — which require protection.

...

The State Nature and Historic Preserve Dedication Act contains many defects. The principal defects are that the dedication process by which areas are made a part of the Preserve is cumbersome, requiring a joint resolution of the General Assembly in each instance, and the exact protection conferred is ambiguous. It is perhaps for these reasons that the Act has lain dormant since its enactment over four years ago.

A good dedication system is one in which the decision to protect an area through dedication is made in light of the sort of evidence which the Heritage Program generates: information about the relative criticality of particular element occurrences. The General Assembly is not the sort of body equipped to make this decision, designed as it is to set general policy for the state. To be sure, the existing Act makes the General Assembly the ratifying agent, not the operating agency. But no operating agency is clearly defined, no particular duties are assigned, no criteria for dedication decisions are given; and despite this, the very cumbersome machinery of ratification through a joint resolution is expected to be set into motion in order to achieve dedication.

The test of the strength of the protection conferred when an area is dedicated is the difficulty of removing the dedication once made. If "dedication" is simply a stamp put on an area by a subsection of an administrative agency and all that is required to remove this stamp is a decision at the same level, the protection is not very strong. On the other hand, if public hearings, an administrative finding of "imperative and unavoidable public necessity," and concurrency by the Governor or the General Assembly is required, the protection is obviously very strong.

Good dedication systems already exist in a number of states. The bill the Conservancy proposes for consideration here is based on these bills and would usefully supplant existing legislation.

...

The North Carolina Land Conservancy Corporation is an empty shell. The Board of Trustees has never been appointed, although the Act creating the corporation is over three years old. More importantly, there would be no point in appointing such a Board. The Corporation should remain unused or, preferably, removed from the statute books.

This is the case for three reasons. First, as originally conceived, the Corporation was unnecessarily confined to one tool for the protection of natural diversity — acquisition — whereas a broader perspective, one capable of utilizing the multiplicity of tools which exist, is what is required. Second, the job of acquisition can also be done by existing private conservation groups. Third, the powers vested in the Corporation can and should be integrated into a government program with the authority to identify and protect the state's natural diversity. A authoritative but protean government program is what is needed for effective protection, not an empty shell.

...

The North Carolina statute on conservation easements simply empowers state and local units of government to acquire and hold conservation easements. Private conservation organizations must also be authorized — as they are in many other states — to acquire and hold these valuable instruments for the protection of natural diversity. There should be statutory clarification of the terminology of easements.

The following draft bill is offered for discussion.

A BILL

To create a Heritage Preserve System

Be it enacted by the General Assembly of the State of North Carolina:

Section 1

Declaration of Policy. The General Assembly finds that as part of the continuing growth of the population and the development of the economy of the state, it is necessary and desirable that portions of the state's rich natural diversity be set aside as Heritage Preserves and be preserved for the benefit of present and future generations before they have been destroyed: for once destroyed they can not be wholly restored. Such areas are irreplaceable representatives of the state's natural diversity, laboratories for scientific research, reservoirs of natural materials not all of the uses of which are now known, habitats for rare and vanishing species, and living museums where people may observe natural biotic and environmental systems.

It is therefore the public policy of the state to secure for the people of present and future generations the benefits of an enduring resource of areas representing the full array of the state's natural diversity by establishing a system of Heritage Preserves, protecting this system, gathering and maintaining a registry, and otherwise encouraging and assisting in the preservation of natural areas of this state.

Section 2

Definitions. In this Act, unless the context otherwise requires:

(1) "Department" means the North Carolina Department of Natural and Economic Resources.

(2) "Natural Area" means an area of land or water or combinations of land and water containing an element or elements of the state's ecological diversity. Such areas are generally relatively undisturbed ecosystems, habitats of endangered, threatened, or unique plants or animals, or any other areas of unusual or outstanding scientific, educational, or ecological interest.

(3) "Heritage Preserve" means a natural area which is formally dedicated under the dedication provisions of this Act.

(4) "Dedicate" means the transfer to the Department, for and on behalf of the state, of any estate, interest or right in an area in a manner permitted in the dedication section of this Act.

(5) "Articles of Dedication" means the writing by which any estate, interest or right is formally dedicated or permitted under this Act.

(6) "Register" means the execution of a written agreement between the Department and a property owner for the purposes and in the manner permitted in the registration section of this Act.

(7) "Critical Areas List" means a list of those areas recommended by the Department that are of critical importance to the goals and purposes of this Act and are therefore eligible to be included in the Heritage Preserves System.

North Carolina Department of Natural and Economic Resources

(a) The Department shall have the following basic duties, responsibilities and powers: (1) to conduct and maintain inventories of the state for heritage program purposes; (2) to select areas for dedication or acquisition; (3) to select areas for recognition and registration; and (4) to manage or provide for the management of Heritage Areas.

(b) Staff. The Department shall have a full-time Director for the Heritage Preserve Program, and shall among other duties, conduct heritage inventories and keep them current. The Department shall supply other staff as needed.

(c) Selection; Establishment. The Department shall have the power to select areas for dedication or for registration; it shall have the duty and the power to establish a system of Heritage Preserves through the acceptance by dedication of donations, through acceptance by dedication of areas already under state ownership, through the acquisition of new areas, and through registration.

(d) Management; Rules and Regulations. The Department shall have the power to establish and adopt rules and regulations governing the use and protection of Heritage Areas. The Department shall have the power to assign, with agency consent, management duties and functions with respect to any particular Heritage Area to any appropriate state agency or agencies and to require that the area or site be managed according to specific rules and regulations.

(e) Registration. The Department shall have the duty and the power to establish and maintain an official registry.

(f) Cooperation. The Department shall have the power to cooperate with federal agencies or other states, counties, or private organizations concerned with similar purposes.

(g) Annual Report. The Department shall prepare an annual report to the governor and to the General Assembly. The report shall briefly describe the activities of the past year and plans for the coming year. It shall detail specific recommendations for legislative action which it deems necessary for the improvement and success of the program.

Section 4

Public Notification and Registration. A notification and registration system will be implemented by the Department. The steps that make up the process are as follows:

Proposals for preserves are to be developed periodically (but at least annually) through the Heritage Program data base-inventory process. The Department program staff must set out priorities among those areas worthy of consideration by applying standards that best serve the purposes of the program.

The Department shall review the recommendations of the Heritage Program staff and approve those areas that are considered to be of critical importance to the system. The list of all approved areas shall constitute, together with areas **approved** under the Dedication sections of the Act, a Critical Areas List.

The Department shall contact the area owner in the manner it determines is likely to be most effective, explaining the program and inviting him to apply for registration. The area shall become officially registered when an appropriate voluntary agreement to preserve the area has been signed by the owner and the Department.

The owner shall be given a certificate acknowledging the inclusion of the area in the system. The owner shall be committed to manage the site under the terms of the agreement and to maintain the specified heritage program values of the area.

The agreement between the owner and the Department may be terminated at any time upon 30 days notification by either party involved. Such termination removes the area from the official registry and the owner must return the certificate to the Department.

Section 5

Dedication. A Heritage Preserve is formally established when articles of dedication for the preserve, or a conservation easement over the preserve, accepted for Heritage purposes by the Department, have been filed in the office of the county recorder (or recorders) of the county (or counties) in which the preserve is located.

The Heritage Program staff must sort out areas worthy of consideration, by applying standards developed from its expertise, that best serve the purposes of the Heritage Program and then recommend to the Department those areas determined to be of importance to the goals and purposes of this Act.

The Department shall review the recommendations of the staff and approve those areas that are considered to be of critical importance to the system. The list of these approved areas shall be included on the Critical Areas List.

The Department shall contact owners of areas on the list explaining the program and inviting them to enter into an agreement that results in the dedication of the area as a Heritage Preserve. Such agreement may result in, but is not limited to, the purchase of the area by the state.

Articles of dedication shall be executed by the owner of the land and accepted by the Department. Articles shall be executed with the same effort as a conveyance of an interest in land and shall be irrevocable except as provided in this Act or in the articles. The articles are invalid unless they adequately restrict, in terms or by reference to Department rules and regulations, the use of the preserve for Heritage purposes, purposes which are enunciated in the policy and goals sections of this Act. The Department shall not have the authority to accept invalid articles.

Articles of dedication may contain provisions for the management, custody, and transfer of a preserve, provisions defining the respective rights of the owner and the operating agencies in cases where they are different persons or entities, and such other provisions as may be necessary or advisable to carry out the purposes of this Act.

Dedicated areas established according to the procedures of this Act shall be exempt from real property taxation and from betterment assessments where no benefit to the property would result.

Section 6

Protections. Dedicated Heritage Preserves are held in trust for present and future generations. They are to be managed and protected according to rules and regulations established in furtherance of this trust by the Department. These rules and regulations cannot be in derogation of the following declared standard.

Heritage Preserves are hereby declared to be put to their highest, best, and most important use for the public benefit. Unless the articles of dedication otherwise provide, preserves shall not be alienated, or altered, or licensed, or taken by any agency or person; not shall the articles of dedication or the conservation easement be changed, except for another public use and: (1) after a finding by the Department of an imperative and unavoidable public necessity and (2) after approval by the Governor. Before these two conditions may be met, however, the Department shall give notice of the proposed action in the major newspaper read in the county or counties in which the preserve is located and shall hold thereafter a prompt and convenient public hearing or hearings in said county or counties at which all persons affected or likely to be affected shall have an opportunity to be heard.

Stewardship. The Department shall make reasonable efforts to inspect dedicated areas to insure that the terms of the articles of dedication are being adhered to. These efforts shall be on an annual basis.

Section 7

Acquisitions

The primary responsibility for acquisition of areas appearing on the Critical Areas List shall rest with the Department. It is not intended by this to limit the Department's existing statutory authority to acquire property, but rather to make the Department the primary vehicle for acquisition under the Heritage Program. Property so acquired shall be dedicated under the dedication provisions of this Act.

Other agencies may acquire and dedicate areas on the list.

Section 8

Conservation easements.

A conservation easement means a right, whether or not stated in the form of a restriction, easement, covenant or condition, in any deed, will or other instrument executed by or on behalf of the owner of land or in any order of taking, appropriate to retaining land or water areas predominantly in their natural, scenic, open or wooded condition, or as suitable habitat for fish and wildlife, to forbid or limit any or all of the following, among other things:

- (1) Construction or placing of buildings, roads, signs, billboards or other advertising, utilities or other structures on or above the ground.
- (2) Dumping or placing of soil or other substance or material as landfill, or dumping or placing of trash, waste or unsightly or offensive materials.
- (3) Removal or destruction of trees, shrubs or other vegetation.
- (4) Excavation, dredging or removal of loam, peat, gravel, soil, rock or other material substance in such manner as to affect the surface.
- (5) Surface use except for purposes permitting the land or water area to remain predominantly in its natural condition.
- (6) Activities detrimental to water conservation, erosion control, soil conservation, or fish and wildlife or habitat preservation, or
- (7) Other acts or uses detrimental to such retention of land or water areas.

No conservation restriction or easement held by any governmental body or a nature conservancy or similar group whose purposes include conservation of land or water areas or a particular such area, shall be unenforceable on account of lack of privity of estate or contract or lack of benefit to particular land or on account of the benefit being assignable or being assigned to any other governmental body or group with like purposes. All such restrictions and easements shall be duly recorded and indexed in the office of the clerk or court or register of mesne conveyances for the county where the land lies so as to affect its title, in the manner of other conveyances of interests in land, and shall describe the land subject to the restrictions of easements by adequate legal description or by reference to a recorded plat showing its boundaries.

Such conservation restrictions are interests in land and may be acquired in the same manner as other interests in land. Such a restriction or easement may be enforced by injunction or proceeding in equity, and shall entitle representatives of the holder of it to enter the land in a reasonable manner and at

reasonable times to assure compliance. Such a restriction or easement may be released, in whole or in part, by the holder for such consideration, if any, as the holder may determine, in the same manner as the holder may dispose of land or other interests in land, subject to such conditions as may have been imposed at the time of creation of the restriction.

This section shall not be construed to imply that any restriction, easement, covenant or condition which does not have the benefit of this section shall, on account of any provision hereof, be unenforceable. The existence of conservation easements or restrictions shall not of itself be proof of value as a measure of damages in any eminent domain proceeding. The intention of this section and of this Act is to create a disincentive and not an incentive to the use of the power of eminent domain with respect to property restricted to conservation purposes.

Section 9

Environmental analyses

The Critical Areas List and other inventory data in the possession of the Heritage Program staff shall become an integral part of the A-95 review process (or any successor thereto) and shall be made available to federal agencies preparing environmental impact statements and to other agencies and individuals, unless the release of certain specific information on endangered or threatened species would jeopardize their existence.

Section 10

Funding. (a) Funding for the Director of the Heritage Preserve Program and the Director's staff shall be provided for by the Department and shall be specifically requested from the General Assembly in the budgets submitted by the Department. Management funds for specific areas and sites for which specific departments have been assigned responsibility shall be requested in the budgets submitted by the department assigned management responsibility.

(b) In order to acquire areas for Heritage Program purposes, the General Assembly is authorized to issue up to \$10 million (\$10,000,000) in general revenue bonds. Bonds so issued shall be known as "North Carolina Heritage Bonds."

(c) The Department is authorized to establish a user fee for Heritage Preserves not to exceed \$5 per year. Such fees shall be charged and use of preserves shall be allowed only in cases where use will not impair the values of the preserve. Such fees shall be in addition to any other fees appropriated for use of the area. The Department shall make available a list of which preserves may be used and what uses may be made of particular preserves. The proceeds of user fees shall be employed to help defray management expenses and shall be divided equitably among those departments assigned management responsibilities.

THE NATURE CONSERVANCY:

Land Conservation Through Private Action

by David E. Morine

Director of Land Acquisition, The Nature Conservancy

IF you drive straight across the breadth of North Carolina, from the Tennessee border to the beaches of the Atlantic Ocean, two facts about the state are apparent. First, North Carolina is one of the most beautiful and naturally diverse states in the U.S., and, second, the Tarheel State is growing rapidly. From the second-home developments that now dot the once wild Appalachians and the quickly urbanizing Piedmont, to the vacation and recreational communities that sprawl along the coast between Elizabeth City and Wilmington, North Carolina's great natural heritage and its desire to grow and develop are meeting head-on.

Up until the 1970's, the choice between growth and land preservation was not a problem in North Carolina. There was plenty of room for everyone. Then, around 1971—largely as a result of the Bald Head Island controversy—many North Carolinians suddenly realized that the land which comprises their great natural heritage was, in fact, a finite quantity. More importantly, they realized that the State's citizens in certain areas would have to begin choosing between preservation and development. The friends of the Eno were one such group of citizens.

The Eno River runs through the Piedmont and has two sources and two forks. Both branches of the Eno—before they reach Hillsborough near Chapel Hill—are lined with mill sites and historical markers of North Carolina's rich history. Beyond Hillsborough, the river meanders its way past Durham through sections of unspoiled wilderness that contain swimming holes with curious names and histories, intriguing rock formations, bluffs covered with rhododendron and mountain laurel, and countryside filled with an abundance of flowers, ferns, and wildlife.

The headwaters of the Eno River are located in the "Research Triangle" of Durham, Chapel Hill, and Raleigh—the heart of one of the fastest growing metropolitan areas in the U.S. Because of its location and uniqueness, the land surrounding the river began

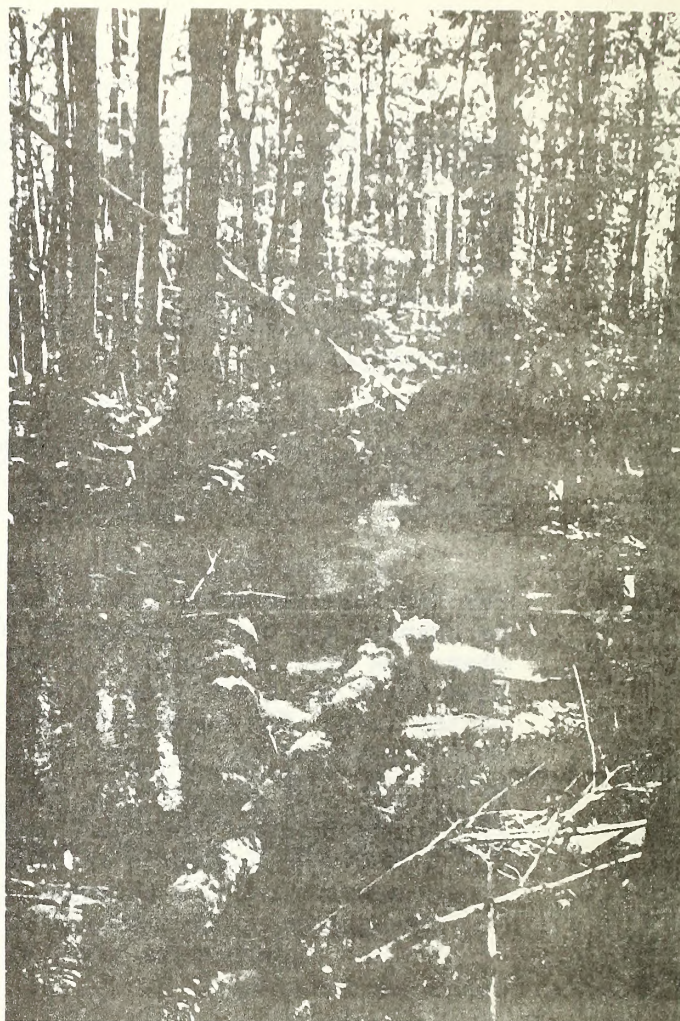


PHOTO BY S. BOURNIQUE

The North Carolina portion of the Great Dismal Swamp (Camden County) is now under public ownership. The Weyerhaeuser Company donated 11,000 acres; Union Camp Corp. donated another 3,800 acres of the Chowan Swamp.

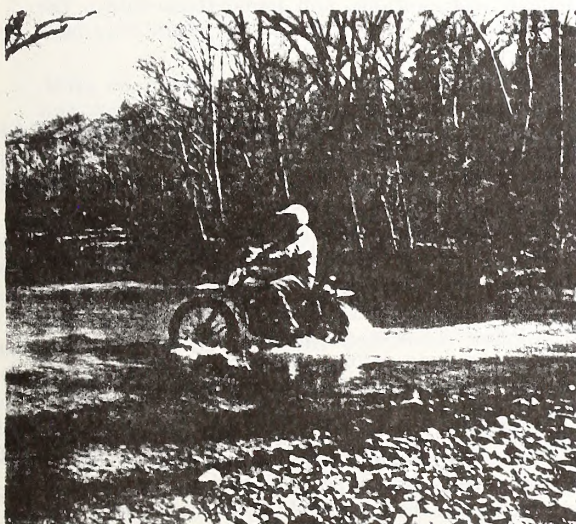
to lure the expanding population of the City of Durham. But the friends of the Eno River strongly felt that Durham's growth could be better accommodated in other areas of the city where the land was not so unique and was suited for development. In early 1972, armed with this conviction and an unlimited capacity for work, the friends of the Eno asked The Nature Conservancy for assistance in preserving the Eno River.

The Nature Conservancy, a non-profit conservation organization located in the suburbs of Washington, D.C., is best described by the slogan on its door, "Land Conservation through Private Action." Incorporated in 1951, the Conservancy has in the last 25 years saved over one million acres of America's most significant natural areas—forests, marshes, beaches, prairies, mountains, and islands. Starting with a membership of only 300, the Conservancy now has approximately 25,000 members. It hopes to triple that number by 1980 because more and more people are realizing that, despite the efforts of government, America's remaining natural areas are being developed and destroyed every



The historic and scenic Eno River in Orange and Durham counties will form the focal point of the Eno River State Park. This will be one of the finest parks of its type in any suburban or urban area, once completed. The river itself is rocky and swift during normal flow periods. It is the home of the Roanoke bass, a fish with a very restricted range in North Carolina.

PHOTOS BY TED DOSSETT



The Eno was subjected to misuse for many years. Even now, problems of overuse exist and place heavy burdens on the present State Parks and Recreation staff stationed on the area.

day. This includes the destruction and loss of vital wildlife habitats, and the disappearance of many already endangered plant and animal species.

To realize the full extent of this loss, we need to understand the significance of species diversity or, more properly, ecological diversity. Every single species or organism fulfills a role that affects each of us, either directly or indirectly. We exist because of our dependence on the existence of other organisms; and each plant and animal species, no matter how rare or how unknown, is a potential resource of indefinite value to man. We need the natural world, the life it supports, and its natural resources as possible sources of food and medicine, and to provide for an environmentally stable, livable earth. The total destruction of ecological diversity also means the destruction of *Homo sapiens*.

The Nature Conservancy uses three basic techniques to acquire threatened natural areas. One technique is to buy the land outright with funds raised through public subscription. Another is to purchase endangered areas and hold them until such time when a gov-

ernmental agency has the necessary funds to repurchase and safeguard the land. Third, the Conservancy accepts full or partial donations of land from private individuals and corporations. It was this last method that initiated the Conservancy's involvement in the Eno River and has led to the preservation of this unique area.

For many years, Drs. Frederick and Mary Bernheim had owned over 90 acres of land along the Eno River. Their property was a key tract because the Conservancy felt that if it could acquire the parcel, other landowners along this stretch of the River would also be interested in preserving their properties. The Bernheims were very concerned about protecting the Eno River. After meeting with the Conservancy and learning how the organization planned to preserve the Eno, the Bernheims agreed to donate their land.

As hoped, after the Bernheims' gift was announced, other nearby landowners quickly followed suit and either donated their properties to the Conservancy or sold their land at well below the properties' fair market values. At the same time, North Carolina's State Parks Department, which had long been interested in creating a state park along the Eno River, rejuvenated their plans. Working directly with the City of Durham, the Parks Department developed a new plan for a park along this 20-mile stretch of the river. Once completed, the Eno River State Park will be one of the finest parks of its nature in any urban or suburban area.

Based on the Eno River experience, The Nature Conservancy developed an excellent working relationship with the State Department of Natural and Economic Resources. Also, the Conservancy felt that if the Department had some funds for land acquisition, there was probably a considerable amount of untapped interest and support for land preservation in the private sector. With this fact in mind, the Department of Natural and Economic Resources brought its case to the 1973 session of the North Carolina legislature, and 11.5 million dollars was appropriated to the Department for land acquisition. In addition, under the direction of the Conservancy, private support immediately began to supplement these state funds.

The Georgia Pacific Corporation donated substantial areas of land in Chowan Swamp and Merchants Mill



Over 1,600 acres on Roan Mountain have been saved as a natural area by the efforts of the Nature Conservancy. This privately funded agency does not retain ownership of such areas, but assists in the acquisition of the lands.

Pond. Mr. R. Philip Hanes, a board member of the Conservancy, pledged over 1,100 acres of land he owned around Stone Mountain to serve as a nucleus for the Stone Mountain State Park. Shareholders of the Core Banks Hunt Club contributed 40 percent of their stock to the Conservancy so that this land could be protected. More recently, the Weyerhaeuser Company donated 11,000 acres, valued at six million dollars, in the Great Dismal Swamp; and the Union Camp Corporation donated another 3,800 acres of the Chowan Swamp.

The First Union Bank of Charlotte provided a different kind of assistance when Mecklenburg County wanted to acquire and protect 427 acres on Mountain Island Lake as a county park. Unfortunately, the owner of the property—a subsidiary of Duke Power—had to sell the land immediately and Mecklenburg County could not obtain the necessary funds soon enough. Since it was obvious that such a park would greatly benefit the community, First Union provided The Nature Conservancy with a loan of approximately one million dollars at a very favorable rate. This timely financing allowed the Conservancy to preacquire the land and hold it until the County was able to obtain its funds.

With this type of private support, the Conservancy has been able to assist public and private conservation efforts in North Carolina by acquiring over 65,000 acres of significant natural areas in the last four years. (See attached box.) The fair market value of these lands has been estimated at approximately 20 million dollars, and only 50 percent of this total has come from state, local, or federal sources. The other half has been provided entirely by the private sector—

North Carolina Projects

Name	County	Acres
Boyd Forest	Moore	403
Chowan Swamp	Gates	13,659
Core Banks	Carteret	950
Eno River State Park	Orange/Durham	436
Freelund Tract	Macon	89
Dismal Swamp	Camden	42,491
Hymettus Woods	Wake	5
Jocky's Ridge	Dare	62
Merchant Mill Pond	Gates	925
Mountain Island Lake	Mecklenburg	427
Olive Tract	Macon	4
Pinky Falls	Macon	6
Roan Mountain	Avery/Caldwell	1,645
Standing Indian Mountain	Clay	1,600
Stone Mountain	Wilkes/ Allegheny	2,852
Timber Ridge Preserve	Jackson	20
Henry M. Wright Preserve	Macon	22
TOTAL:		65,596

individuals, corporations, and foundations within the State that wanted to see the best of North Carolina's natural areas preserved.

Of course, North Carolina will continue to grow. Everyone realizes that the entire state cannot and should not be preserved. However, no one can deny the significance of natural areas like the Eno River, the Great Dismal Swamp, Roan Mountain, Merchants Mill Pond, Core Banks, and Stone Mountain. But now that these examples of the State's natural heritage have been preserved, where should the conservation community continue to apply its limited resources?

Fortunately, the Mary Reynolds Babcock Foundation in Winston-Salem recognized this problem and agreed to help fund a joint program between the Department of Natural and Economic Resources and The Nature Conservancy. This program, called the North Carolina State Heritage Program, will determine the state's most significant natural areas through an intensive statewide inventory. Relevant data on natural areas throughout the state will be collected and stored in an on-going system or data bank and will provide the information needed to determine the areas most worthy of protection. For example, researchers will classify North Carolina's rare plant and animal species, plant communities, and critical habitats, as well as important historic and recreational sites and outstanding geologic features. In this way, information on the existence, numbers, condition, status, and location of all these significant examples can be objectively ascertained. Once this information is accumulated and stored in the Department of Natural Resources, North Carolina can go about setting protection priorities and preserving its natural heritage. In addition, the data can be used by other state, local, and federal agencies, and the private sector to determine how to best accommodate the State's future growth, and to show which areas safeguard what is endangered or rare.

Significant natural areas are often destroyed simply because their uniqueness has not been documented. Hopefully, through the State Heritage Program, the Department of Natural and Economic Resources and the Conservancy will help the people of North Carolina and their elected and appointed officials to be-

• continued on page 27

• **NATURE from page 20**

come more aware of their natural heritage before it is too late. By setting preservation priorities, the Heritage Program can assist the State in developing the tools it needs to make growth and conservation compatible in North Carolina.

In order to implement the State Heritage Program, the Conservancy needs your help. Government alone cannot do the job—it needs the continued support of North Carolina's private sector. The Nature Conservancy plans to open a state office in North Carolina in 1977. To do this, the Conservancy is launching a \$100,000-fund-raising campaign. Half of this amount

is needed to create the state office and implement the Heritage Program; the other half will be used as a North Carolina land preservation fund—a revolving fund that would be available for future land acquisition and preservation in the State. In addition, the Conservancy is seeking 2,500 dedicated conservationists to help save North Carolina's significant natural areas.

If you wish to make donations or want to know more about what you can do to help, please write The Nature Conservancy, 1800 North Kent Street, Arlington, Virginia 22209. "Conservation through Private Action" will continue to preserve and protect North Carolina's great natural heritage. ♦

Our "Goodliest Land" - Where?

by **Charles E. Roe**
Coordinator, N. C. Natural Heritage
Program



EVEN today the pronouncement of early settlers that North Carolina is the "goodliest land" holds true. We need not be told of the natural beauty and diversity possessed by our state. We can see that fact, no matter the direction, from mountain vistas and white-waters to beach dunes and surf, from spruce-fir forests to cypress swamps, spartina salt marshes to health balds, montane bogs to coastal pocosins, trout streams to black water embayments, piedmont bottomland woods to marine coral encrusted reefs. We know our North Carolina is rich in its magnificence.

But we also know that each year a bit more of this natural heritage disappears to the blade and burn, the fill and blasting that come with urbanization and the quest for prosperity. Our wildlife, particularly the native non-game species, are pushed back into ever more isolated enclaves. State scientists and resources managers list several hundred native plant and animal species whose survival is endangered or threatened.

What progress has been made for identifying and protecting unique natural areas and natural habitats in our state?

The North Carolina Natural Heritage Program is responsible for inventorying the special ecological elements that make for the importance of North Carolina's natural lands and, using this information, planning for the protection of the most significant natural areas. We do not work in isolation, since many others pursue similar concerns.

The Department of Natural & Economic Resources last year requested The Nature Conservancy to initiate the Natural Heritage Program for the State of North Carolina, as it has done for South Carolina, Tennessee, and West Virginia.

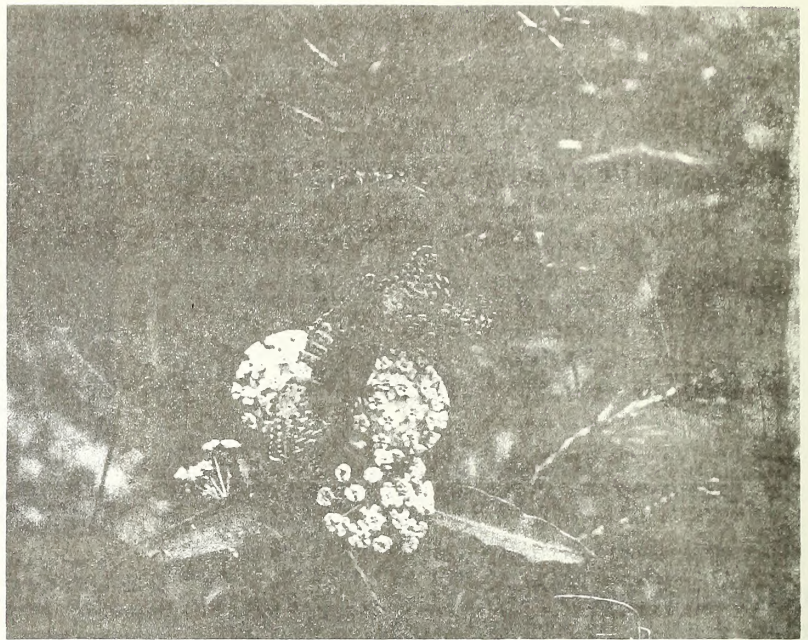


PHOTO BY ROBERT E. DEYLE

We are fortunate in North Carolina to have numerous unspoiled areas, some a few acres, and several rather extensive. Whether these represent homes for fritillary butterflies (above) or black bears, they need to be located and preserved.

Indicative of the tradition of private support for conservation in this state, the Mary Reynolds Babcock and Z. Smith Reynolds Foundations, with matching money from the federal Bureau of Outdoor Recreation, donated the funds for operation of the Heritage Program in its first year. The December, 1976, issue of this magazine described the work of The Nature Conservancy, a national nonprofit organization devoted to preserving unique natural areas through private action.

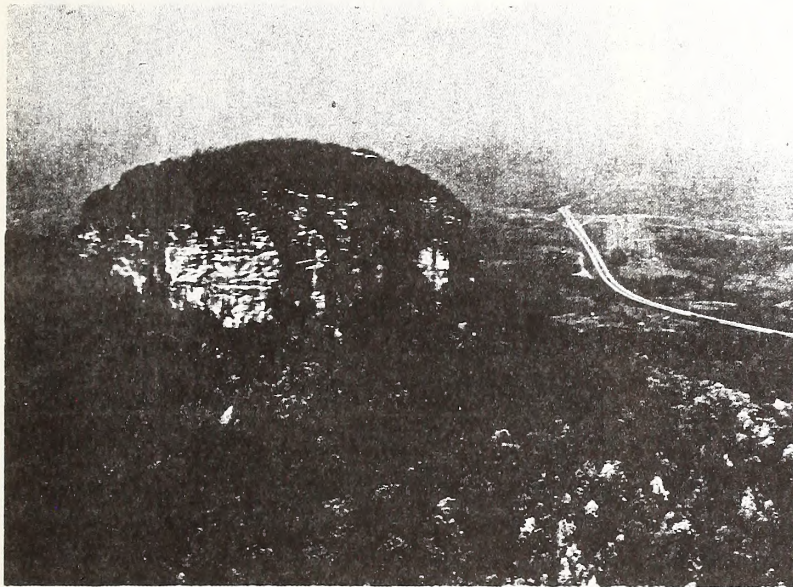
In its initial year the Natural Heritage Program has rapidly assembled comprehensive information on North Carolina's natural diversity. The information collected and recorded on maps and computer retrieval system aids resource managers, conservationists, and scientists. If the Natural Heritage Program is incorporated as part of a state agency, the program will provide a full assortment of information services needed for our public works planners, natural resource managers, local officials, and other decision-makers to direct North

Carolina's growth while protecting precious natural values.

The goal of the Natural Heritage Program is to help preserve our natural diversity by contributing to improved environmental impact analysis, identification of special natural features, stimulation of public and private acquisition of natural preserves, and encouragement of land conservation by private property owners through programs of education, dedication, conservation easements, and tax incentives.

The research of the Heritage Program, discussions with scientists, park naturalists, refuge managers, and citizen conservationists, our reviews of museum and herbarium collections and scientific research of others, and field reconnaissance work has vastly increased our appreciation for North Carolina's natural lands. We could write of the majesties of many natural areas, but let that come later. Our concentrated study of the state's resources has also impressed us with the grim realities of their destruction and the fragmented condition of con-

Public interest and support of the Natural Heritage program is fundamental to its success. Significant areas of natural interest once lost are gone forever.



DNER PHOTO

Many of the natural areas in our state contain some unique geological feature such as Pilot Mountain shown here, or perhaps a special plant community which needs protection. Public support of this program is needed now.

servation efforts.

The Natural Heritage Program attempts to bridge gaps and coalesce information and conservation efforts. Yet, others also work to understand and to protect our natural diversity.

The scientific community within our universities is the most able and respected among the Southern states and furnishes critically needed research on natural areas and endangered species. The Highlands (NC) Biological Station, a consortium of southeastern universities supported by foundations and public grants, is striving to advance ecological research.

The State Museum of Natural History, a part of the N.C. Department of Agriculture, has established a high degree of excellence in zoological research and environmental education. It has sponsored preparation by expert scientific committees of a non-official list of the state's endangered and threatened native animals and plants. The dream of the State Museum is a desirable one: creation of an inter-agency, multi-disciplinary North Carolina

Natural History Survey.

The Wildlife Resources Commission seeks to improve and expand a management and biological research program for protection of endangered, non-game wildlife species. Financial support from hunters, fishermen and the public in its "Carolina Conservationist" program and funds from license revenues have not been sufficient to fully administer this ambitious project to date.

The Division of State Parks & Recreation has made acclaimed advances in building the state park system in recent years, including the donation of several natural preserves and doubled state park acreage. The Natural Heritage Program builds upon the work of the Division's natural areas studies coordinator, naturalists, and natural and scenic rivers program.

The N.C. Land Policy Council proposes that all counties devise public plans for their future growth. Proposed land classification plans would identify certain areas of environmental concern, agricultural and other naturally productive lands where future urban develop-

ment would be discouraged. The Land Policy Council is also devising a land resources information service to aid local governments and citizens.

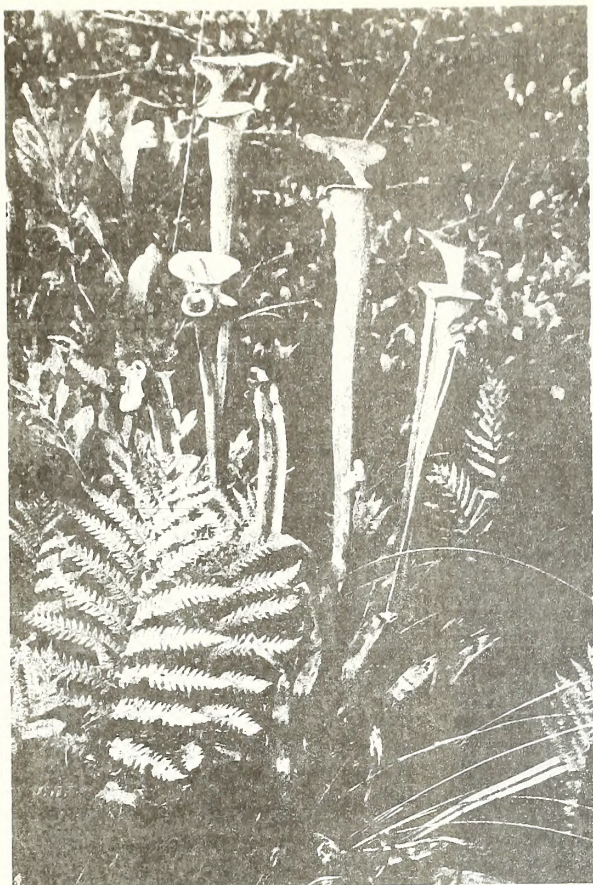
The Department of Natural & Economic Resources is the locus of the state's acquisition and preservation efforts for critical natural areas. The Department's resource management divisions and commissions (parks and recreation, forestry, fisheries and marine affairs, environmental management, environmental assessment, coastal resources commission, national parks and forestry commission) in sum offer the principal public vehicles for safeguarding our state's natural heritage.

Other governmental and private agencies and universities have set aside wilderness areas, wildlife refuges, preserves, forests, and seashores. A potentially powerful public base of support for land conservation exists within such organizations as the Wildlife Federation, Garden Clubs, Conservation Council and Conservation Foundation, Wild Flower Preservation Society, Audubon and Sierra Club chapters, Trout Unlimited, as well as numerous regional and local coalitions, such as the People to Preserve Jockey's Ridge, Northwest Environmental Preservation Association, Eno River Association, Upper French Broad Defense Association, and Committee for the New River.

Preeminent among these private efforts is the N.C. Botanical Garden, centered in Chapel Hill. Beyond its propagation, research, and rescue operations for native plants, the Botanical Garden is devoted to public education and protection of natural habitats. The Botanical Garden possesses several natural preserves.

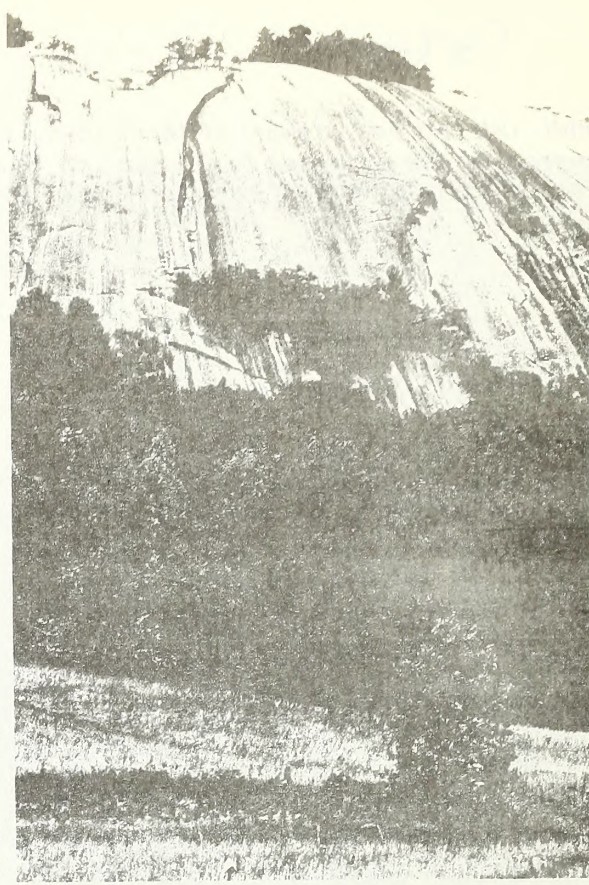
Citizen or private involvement is essential for protection of our natural lands. Citizens efforts may be more critical, more important than government endeavors. Ultimately the people of North Carolina are the guardians of their state's rich natural resources. Governmental action follows the sentiments of the public.

Even now the conservation activities of public and private sectors are fragmented. The challenges demand concerted, allied action. This conceivably can happen on the government's side through joint attention by concerned agencies. Interagency cooperation, though difficult to achieve, offers greater pos-



PHOTOS BY ROBERT E. DEYLE

Important natural areas range from the bogs of the Coastal Plain with rather rare plants such as these yellow pitcher plants and Virginia chain ferns to highland and mountain...



...spots with massive rock formations like Stone Mountain, the central attraction of Stone Mountain State Park. The time remaining to place such areas under protection is short.

sibility of success. Active involvement, support and initiative on the part of private organizations and concerned citizens, however, are the key ingredients for achieving our goals of retaining our natural heritage.

How can the isolated and divergent public interests for land conservation be coalesced? Just as the Natural Heritage Program is intended as a bridging and building mechanism for public agencies, so too does The Nature Conservancy hope to galvanize a coalition of citizen interests. Establishment of the North Carolina Nature Conser-

vancy, a branch of the national organization, provided potential financial resources, professional abilities, and membership base both to support and provide alternatives to governmental programs. Working with other conservation organizations and universities, the North Carolina Nature Conservancy offers North Carolinians an opportunity to take an active role in seeing the natural beauty and diversity of our

state preserved.

North Carolina's natural heritage can be best protected through the cooperation of government agencies, private organizations, and concerned citizens, using a wide range of protection techniques. North Carolina possesses a rich, though endangered, natural heritage. The state has the potential to conserve its heritage if its people choose to do so. ♦

North Carolinians who are interested in helping preserve their state's irreplaceable natural heritage may join the North Carolina Nature Conservancy, a branch of the national organization. Membership categories are: \$500—Life; \$100—Guarantor; \$50—Supporting; \$25—Contributing; \$15—Family; \$10—Subscribing; \$5.00—Student; \$1,000—Corporate. Dues include membership in the national organization, and a subscription to the quarterly magazine. Send your check made payable to The Nature Conservancy with your name and address to: P. O. Box 805, Chapel Hill, N.C. 27514. For more information about the N. C. Nature Conservancy, write Field Representative Tom Massengale at the above address. Remember, all contributions are tax-deductible.

The North Carolina Nature Conservancy

The North Carolina Nature Conservancy is a branch of The Nature Conservancy, a national, nonprofit organization that has helped preserve over one million acres in the United States, including over 65,000 acres of significant natural land in North Carolina alone. The Nature Conservancy in North Carolina has played an important part in the protection of such varied areas as Great Dismal Swamp, Jockey's Ridge, Roan Mountain, Chowan Swamp, and Stone Mountain.

The Conservancy has achieved this record of "Land Conservation Through Private Action" by applying practical business skills to the job of protecting ecologically significant land. The Conservancy purchases land using its revolving fund which is replenished through local fund-raising; accept gifts of land; and retains and provides stewardship for about sixty percent of its projects. The Conservancy also works with government agencies to identify and protect important natural areas, and has the ability to make rapid acquisitions, for later transfer to government agencies.

Much work remains to be done in North Carolina. The North Carolina Nature Conservancy has established its state office with a state executive director, board of directors composed of leading citizens, and an advisory committee composed of scientists and other authorities. Fundraising and citizen membership campaigns are under way. The Conservancy hopes to work closely with other conservation organizations to acquire and preserve specific natural areas identified by the Natural Heritage Program inventory.

The North Carolina branch of The Nature Conservancy will use the resources of the Natural Heritage Program to learn which lands most need to be saved, and to be sure that proper protection is guaranteed. The information gained from the North Carolina Natural Heritage Program is valuable only to the degree that it is used. To identify a need is not enough. There must be a way to quickly and positively respond to the need. This can be accomplished through the state Nature Conservancy program.

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RECOMMENDATIONS

A mature Natural Heritage Program will concern itself with a number of functions:

EDUCATION	promote public concern for conserving natural diversity
INVENTORY	identify elements of natural diversity and natural areas
ANALYSIS	determine significance and protection priorities for natural areas
PROTECTION PLANNING	develop means of protection
IMPLEMENTATION	implement strategies for protection and management of important natural areas.

The rapid progress of the NC Natural Heritage Program in its initial year promises that the Program can soon carry out these responsibilities.

The short-term extension of the contract between the State of North Carolina and The Nature Conservancy permits continuation of the Natural Heritage Program while a search is made for funding and decisions are made regarding the administration of the Program. (The Nature Conservancy estimates the budget need for an operational Natural Heritage Program is \$87,150.) The four month contract extension will allow a transition to the Program's demonstration stage. During the transition period, the information base will be expanded, directions of the Program will be assessed in view of reactions to this report, and the proposed natural area selection criteria will be used to draft a list of significant areas deserving protection action and requiring more complete field surveys.

Other activities of the Natural Heritage Program in its second stage of operation are suggested in the following recommendations.

Demonstration Program

During its second year, the Program should clearly demonstrate its effectiveness and importance as a conservation planning tool. Principal functions and responsibilities of the Program in its second year would be the following:

1. Develop and maintain the information system
 - a. Identify and record significant natural features and elements of natural diversity
 - b. Provide access to data
 - c. Contribute to the environmental assessment process

2. Promote Departmental policies and actions for natural areas protection on state-owned lands
 - a. Recommend protection priorities and criteria
 - b. Establish natural areas management policies and procedures and assist in developing management plans
 - c. Provide consultation and advice to land managers
3. Develop and implement strategies for protection of significant natural areas in private ownership
 - a. Identify preservation/protection priorities
 - b. Advance public awareness and promote volunteer support and participation
 - c. Propose legislation to implement recommended strategies

Information Base Expansion

Much time has been expended conducting the research activities essential to the creation of a dependable element data base. The collection of known information about element occurrences is by no means complete. Many of the 3500 occurrence reports thus far assembled need more precise locational and ownership information and verification of presence. Enrichment and refinement of the information base should be one primary objective of future Heritage Program efforts.

Numerous primary and secondary sources of information on natural elements remain to be tapped. Specific information gaps are found in all element classes. Continuation of the inventory should serve to fill in major data gaps and to canvass the remaining principal sources of data.

Our inventory of special plant and animal species has been based on classification lists prepared as the best judgment of committees of scientific authorities. These lists of endangered and threatened plants and animals in North Carolina are not official and are backed by no state regulation. In some instances the 1975 State Symposium list of special species deserves refinement. No legislation or administrative direction yet exists which requires the promulgation of such lists, or assigns a government agency or agencies the responsibility for conducting a comprehensive program for protection of endangered and threatened species habitats.

Information which has been assembled regarding unique, unusual, and high-quality representatives of physical and aquatic features should be cycled back through authorities for editing and refinement. Use of aerial or remote sensing data could provide additional information on both physical features and also plant communities.

Plant community location and composition information has been difficult to obtain because few botanists have conducted community studies that fit the detailed nature of the classification system. Even generalized studies of major cover types have been relatively limited in number. Most botanical field work has been aimed toward identification of species present,

not with regard to plant community types, soils, or other site factors associated with the individual species under study. Acceptance and adoption of the survey techniques being developed by Dr. A. E. Radford and associates should overcome the weaknesses of past studies of vegetation associations. To surmount the obstacle of plant community data insufficiency, Heritage Program personnel must work closely with the state's plant ecologists and encourage improved methods of inventorying plant communities.

The Natural Heritage Program should continue to work in cooperation with the state's natural scientists in order to assure the Program's maximal effect on the natural heritage of North Carolina. This can be done through informal relationships, committees, and workshops to examine in depth and to define documentation standards, the classification of natural diversity, basic and long-range inventory levels, and evaluation processes.

Working closely with the university community, the Natural Heritage Program can contribute to the achievement of the following recommendations:¹

1. The conservation of species, communities and habitat diversity.
2. The ecological characterization of species, communities and habitats.
3. A predictive system for species, communities and habitats.
4. Perspectives in species biology studies, community analyses and habitat significance.
5. Interpretation of origin, migration and evolution of species, floras, faunas and communities.
6. Integrative classifications of many types, i.e. map systems, habitat productivity, etc.
7. Decisions on land use, impact evaluation and management problems of many types.
8. Research foundation for applied and advanced problems in many fields of endeavor - i.e. hydrology, pedology, habitat cover, food productivity, etc.

¹These recommendations are adopted from those made at the UNC Environmental Studies Council's Workshop Conference on Natural Areas in North Carolina, April 29, 1977.

Natural Area Identification Criteria

The proposed element status summary approach will be applied to the data base for the selection of significant natural areas deserving additional field surveys and protective attention. This draft list will be prepared by the staff of the Heritage Program, with assistance from the DNER Natural Areas Advisory Committee. The identification process will facilitate the development and implementation of strategies for protection of the significant natural areas in private ownership. It will also facilitate the development of protective action and management policies for natural areas on state-owned lands.

Data Security

The dissemination of specific locational information on fragile or vulnerable species and features should be made on a need-to-know basis. The disclosure of specific locations containing exploitable features (rare or critical species populations, etc.) to individuals may lead unintentionally to the destruction of an irreplaceable natural resource.

Sensitive information should be applied where and when it is needed, i.e. initial planning for a highway, impoundment, water treatment facility, or other proposed project. The Natural Heritage Program promises to be a powerful tool for planners, scientists, land managers, conservationists, engineers, and other public decision-makers. But data should not be indiscriminately disseminated to individuals who lack the knowledge to accurately assess the significance of the data.

Natural Areas Protection Policies and Legal Recommendations

North Carolina's natural diversity can best be protected by public and private cooperation, using a wide range of protection tools. In order to promote revised and improved public policies toward natural areas on state-owned properties, consultation and discussion within the Department of Natural and Economic Resources and with other concerned agencies will be necessary.

Feedback is sought to the draft legislation proposed in this report. A legal advisory committee should be organized. Such a legal advisory committee might include state legal counsel, members of the NC Nature Conservancy board of directors, environmental and property law specialists from the Institute of Government and University of North Carolina law school. The legal advisory committee would review existing legislation and administrative policies affecting management of natural areas in public ownership. The staff will present to the committee its evaluation of other states and private conservation organizations working in natural areas management and protection. The committee will recommend application of suitable measures for North Carolina's needs and will recommend necessary legislation.

The Natural Heritage Program should give immediate attention to identifying sites on state-owned lands worthy of designation as natural areas and to develop administrative procedures for formal designation.

The Heritage Program should seek to preserve natural areas on private lands through voluntary landowner cooperation. The staff will develop approaches, such as conservation easements and notification or recognition, which may be immediately utilized without new statutory authority.

The Program staff should provide technical consultation and advice to public land managers and private landowners concerning natural areas management.

Relationship with DNER Natural Areas Advisory Committee

The Natural Areas Advisory Committee recently resolved to perform the following activities and tasks:

1. Analysis of inventory and preservation priorities; consideration of sites for natural area designation (Private and public other than Parks and Recreation lands)
 - a. Heritage inventory analysis and review
 - b. Preliminary recommendations for site designations
 - c. Recommendations for further inventory field studies
2. Consideration of candidate sites for natural area designation on Parks and Recreation lands
 - a. Review of preliminary proposals
 - b. Recommendations for designation
3. Protection planning and development of protection strategies
 - a. Recommendations on implementation priorities
 - b. Review of Coastal Resources Commission proposals for AEC designation of natural areas
4. Involvement in Parks and Recreation master planning process
 - a. Resource analysis
 - b. Preliminary recommendations to planners
 - c. Review of proposed plans
5. Natural area management and protection
 - a. Management recommendations
 - b. Review of draft management plans
 - c. Development of general guidelines for management, protection and use of natural areas
6. Committee representation on Parks and Recreation Council
7. Quarterly advisory committee meetings

The Natural Heritage Program staff should work closely with the Advisory Committee, both in providing it support and in soliciting its recommendations.

Relationship with Other State Agencies and Programs

Because the responsibilities and objectives of the Natural Heritage Program are inter-agency in scope, the Program should continue its close coordination with other concerned state agencies. Coordination and cooperation should be maintained with all resource management divisions of the Department of Natural and Economic Resources, the State Museum of Natural History, Wildlife Resources Commission, Environmental Assessment, Department of Administration, Coastal Resources Commission, and Land Policy Council. Within the Division of State Parks and Recreation, the Heritage Program inter-relates with system planning and research, site planning, environmental planning, consulting services, park interpretation, and other resource management functions.

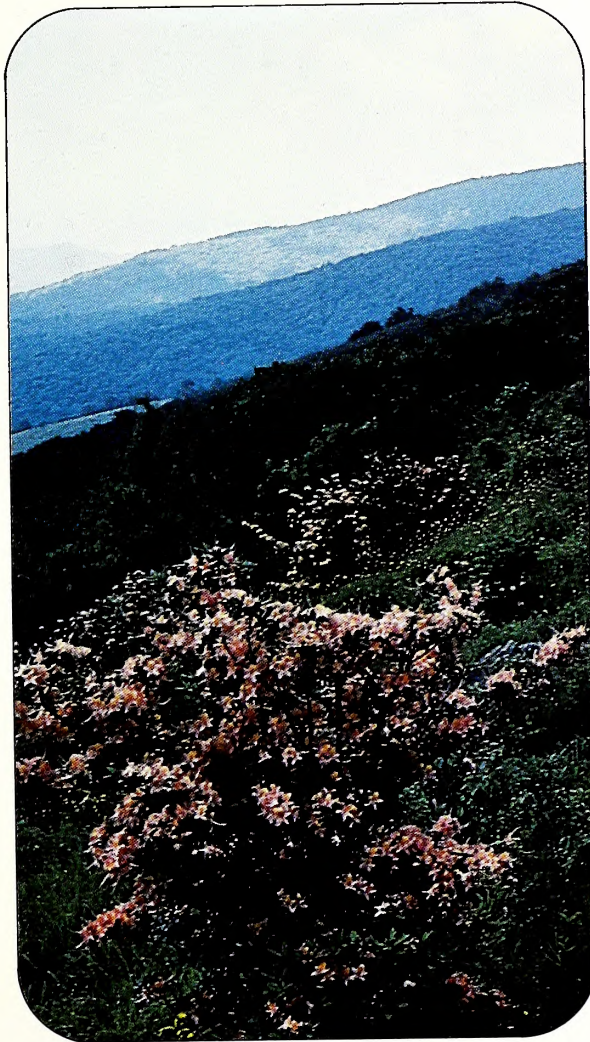
Archeological and historical site inventory and protection activities are the responsibility of the Department of Cultural Resources. Natural element occurrences and cultural resources often share common locations. Protection efforts for natural elements and cultural features frequently share common goals and methods. The separation of the identification and protection programs for natural and cultural resources may be artificial. Close coordination and cooperation should be encouraged between the Natural Heritage Program and the historical/archeological inventory and preservation programs of the Department of Cultural Resources.

Public Involvement

The Heritage Program must rely heavily upon lay public and professional involvement to continue its ongoing inventory and protection efforts. The general public can suggest unique natural features to the Heritage staff and can provide non-technical support for protecting natural areas. Professional support is most important. Scientists supply information regarding the location, composition, and distribution of natural elements and make recommendations for management activities to enhance and preserve natural areas. As the inventory progresses, field surveys are required for which naturalists, advanced science classes, and other qualified individuals and groups are needed to volunteer as field surveyors. Volunteers can usefully contribute to many other phases of the program.

Appendices





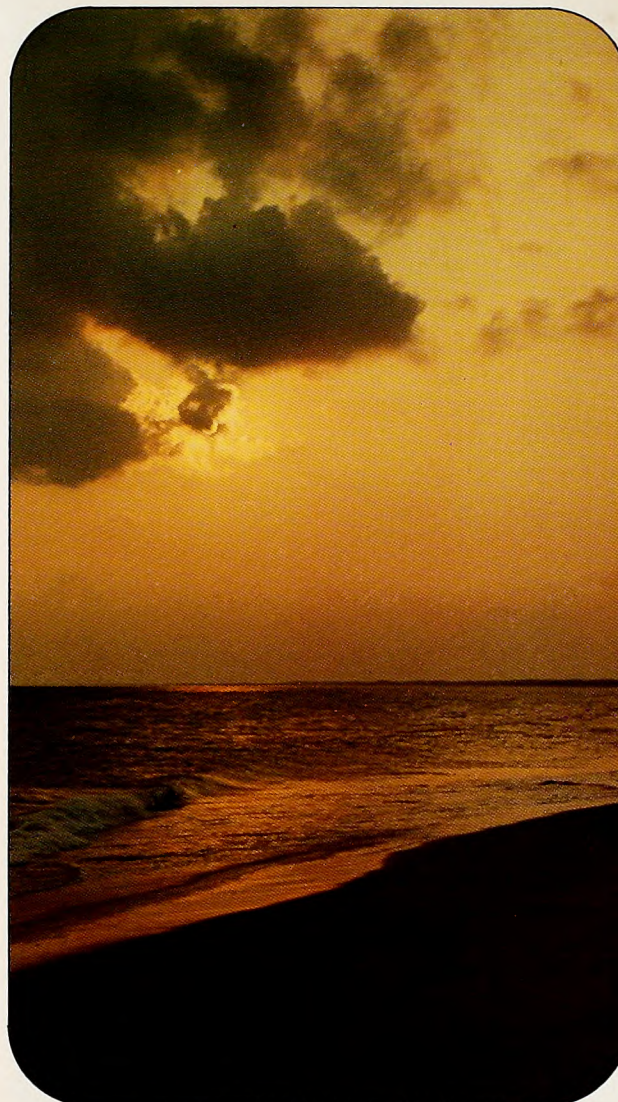
*The
North Carolina
Natural Heritage
Program*

Fifteen thousand of these public information brochures were printed and distributed.



YELLOW PITCHER PLANT

PHOTO CREDITS: Roan Mountain, Philip Hanes; Cape Hatteras, Stone Mountain, Venus' fly trap, rhododendron, Carolina lily, and White Oak Creek, North Carolina Department of Natural and Economic Resources; pitcher plant and outer banks, Charlotte Jones (North Carolina Botanical Garden); windswept outcrop, Rob Gardner (North Carolina Botanical Garden); five-lined skink, Jim Ward (North Carolina Botanical Garden); bobcat, North Carolina State Museum of Natural History; brown pelican, James F. Parnell; black bear, North Carolina Wildlife Resources Commission; cardinal flower, Ronald M. Rauch; Roosevelt Natural Area, Robert P. Teulings.



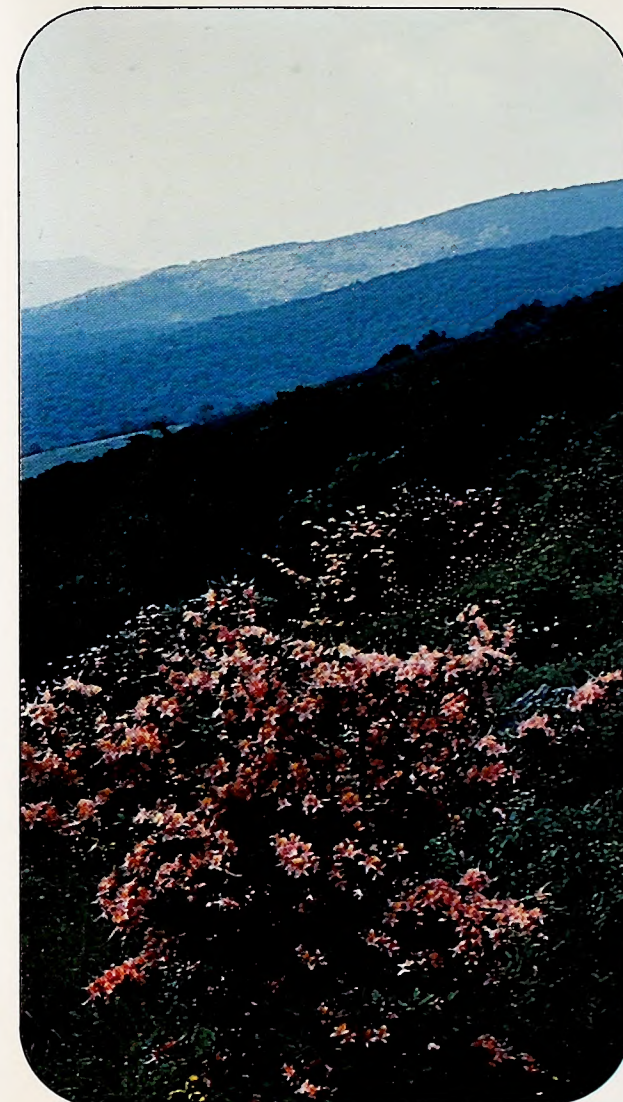
CAPE HATTERAS



DEPARTMENT OF NATURAL
AND ECONOMIC RESOURCES

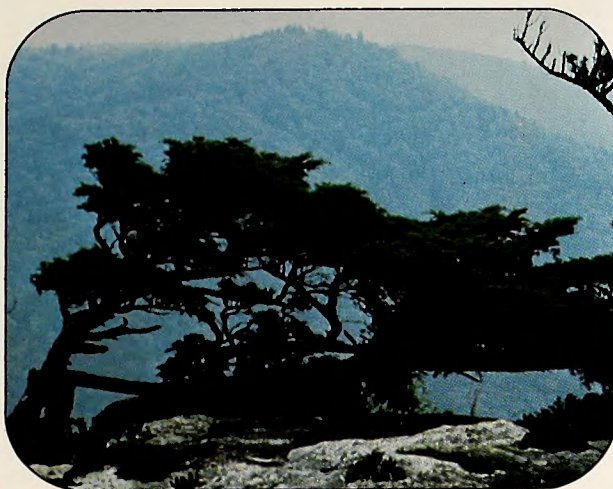


The North Carolina Natural Heritage Program
N.C. Department of Natural and Economic Resources
P.O. Box 27687
Raleigh, North Carolina 27611



The North Carolina Natural Heritage Program

ON THE COVER: Roan Mountain in the springtime,
ablaze with flame azaleas.



WINDSWEPT OUTCROP

North Carolina's Natural Heritage

North Carolina owes its unique natural heritage to a vast range of distinctive natural features and ecosystems. The state's land resources include the highest mountains in Eastern America, a profusion of animal and plant species, plunging streams and waterfalls, lush forests, singular monadnock peaks, the rolling piedmont, wide dark rivers, unusual sandhills, expansive swamps and marshes, long stretches of beaches and barrier islands, the nation's largest coastal sand dunes, and large embayments and sounds.

North Carolina's natural heritage must be protected, as man's needs continue to expand at an ever-increasing pace. Natural areas are living libraries which are essential for the study of natural history and scientific research, which benefit all mankind. These areas also represent havens for a multitude of plant and animal species, each occupying a place in a balanced environment. As the trend toward ecological awareness has underscored the interdependence of all living things, there has been a dawning realization that our natural resources must be carefully conserved to ensure man's continued well-being and ultimate survival.

The protection of North Carolina's natural heritage has long been a cooperative effort of government, concerned citizens, and private agencies. In the past three years, the Department of Natural and Economic Resources has more than

doubled the acreage of the state park system. In addition, other government and private agencies have set aside wilderness areas, wildlife refuges, preserves, forests, and seashores. The North Carolina Natural Heritage Program will reinforce these efforts through identification of important natural areas, and setting priorities for protection.

The North Carolina Natural Heritage Program

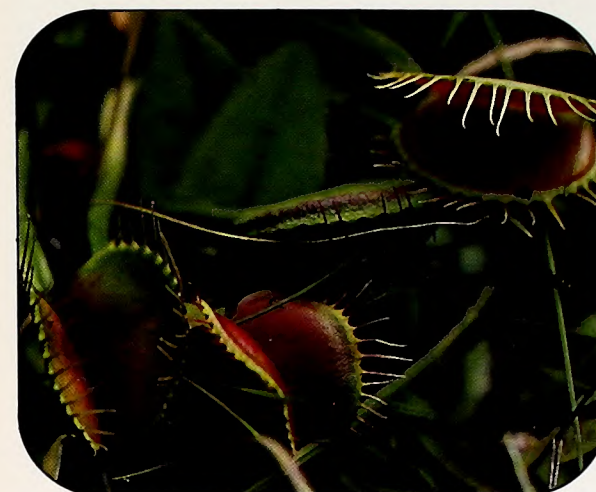
The North Carolina Natural Heritage Program represents the first comprehensive attempt to



BOBCAT



FIVE-LINED SKINK



THREATENED VENUS' FLY TRAP

determine the state's most significant natural areas, through an intensive statewide inventory. When sufficient information has been gathered through the inventory to identify and evaluate areas of prime ecological significance, recommendations for protection of these areas can be made. However, the inventory is a continuous process, and becomes a scientific tool of increasing value as it progresses. The Natural Heritage Program is being administered through the North Carolina Department of Natural and Economic Resources, which has contracted with The Nature Conservancy to develop the program. In the South, similar endeavors are under way in South Carolina, Tennessee, Mississippi, and West Virginia. A national nonprofit organization dedicated to the preservation of ecologically significant land, the Conservancy has assisted the state in the acquisition of several outstanding natural areas. The Heritage program is being funded by a grant from the Mary Reynolds Babcock Foundation, with matching funds from the federal Bureau of Outdoor Recreation.

With the information yielded by the Heritage program, the state can identify the areas which best represent its natural heritage, and determine if they are being adequately safeguarded. Long-term results of the program can mean that the state's resources will be available for the benefit and enjoyment of the generations of mankind yet to come.

The Natural Heritage Inventory

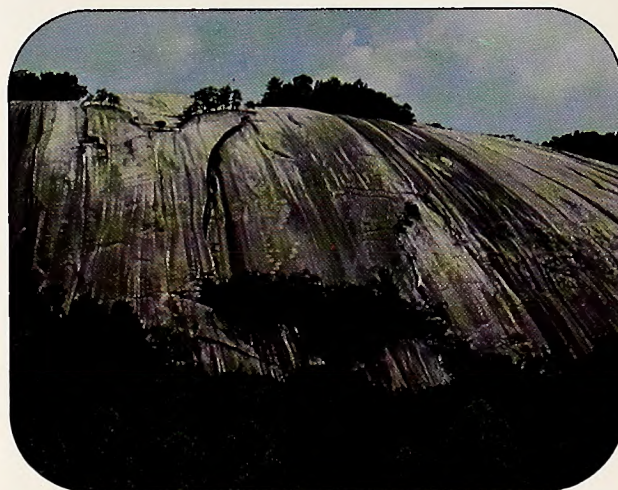
The inventory will guide the state in the protection of its natural heritage by providing the information essential to determine the most significant natural areas. The prelude to making informed decisions regarding North Carolina's most valuable areas, the inventory emphasizes the continuous refinement and analysis of relevant information. This information is collected, stored, and made available as necessary for a wide array of decisions affecting existing and potential areas.

The innovative inventory focuses first on the elements of natural diversity themselves, an element being a natural feature of particular interest because it is exemplary, unique, or endangered on a statewide or national basis. A classification of element types has been developed as the cornerstone of the inventory process, so that researchers can catalog the state's vulnerable plant and animal species, plant communities, aquatic types, and critical habitats, as well as outstanding geologic features. Information on the existence, numbers, condition, status and location of all significant examples can then be objectively determined. Detailed information on all these resources is invaluable in setting protection priorities.

Through the element-based inventory, vital aspects of North Carolina's resources will be identified. While there is little chance that the worth of a well-known scenic area would be unrecognized, little-known or remote areas rich in ecological diversity or havens for endangered

species might otherwise escape attention.

The Heritage inventory is a cumulative process. As more information is updated and refined, the ability of experts to identify and evaluate the natural



STONE MOUNTAIN



BLACK BEAR



NORTH CAROLINA'S OUTER BANKS

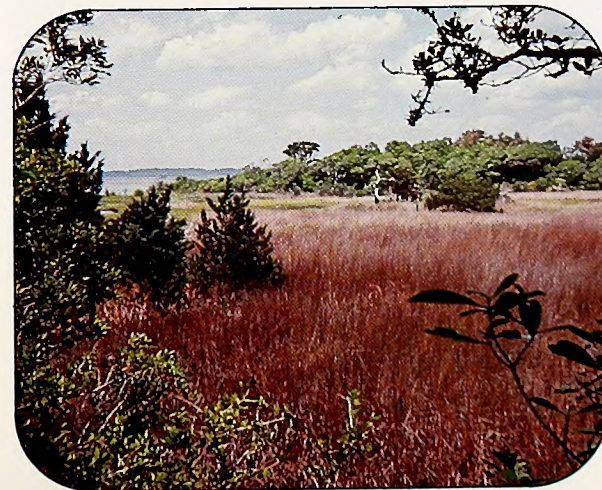
areas within the state will continuously improve. Once these areas are identified, techniques for protecting them can be studied, recommended, and implemented.

Balancing Our Needs

The protection of North Carolina's natural heritage can be accomplished in harmony with man's other interests, if planning accompanies progress. The information yielded by the inventory can point to fragile areas, the use of which should be strictly limited, but it can also play an important role in planning the wisest use of all our land. Protection of the environment means not only setting aside delicate areas, but planning for minimal environmental destruction of other areas.

The Heritage inventory results can be utilized in the preparation of environmental impact assessments, as well as in proper planning of commercial and residential development. Planners, developers, and other decision-makers can be made aware of the effects of alternative courses of action before commitments are made, ensuring minimal adverse impact on the environment, and avoidance of unnecessary conflicts.

We can no longer afford to serve one interest without carefully weighing all considerations. If a highway is routed around an endangered species habitat, for instance, an important contribution to the preservation of ecological diversity has been made. At the same time, the demands of progress have been accommodated. All interests benefit.



ROOSEVELT NATURAL AREA



ENDANGERED BROWN PELICAN

Protection of Natural Lands

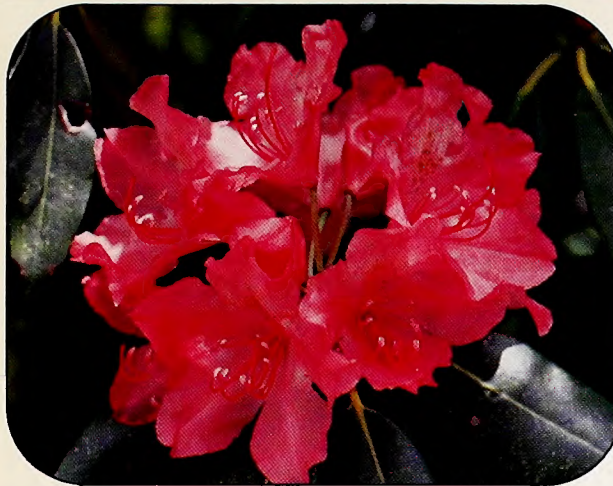
North Carolina's natural heritage can be best protected through the cooperation of government agencies, private organizations, and concerned citizens, using a wide range of protection techniques. The level of protection extended to an area depends on many factors, such as the relative rarity of its features. Many protection techniques involve private landowners who would like legal assurance that their land's natural values will be kept intact.

Land acquisition may be advisable to assure protection of highly critical areas, and may be achieved by several means. Many significant natural areas which exist under the protection of public or private agencies have survived due to the foresight and generosity of those who once owned them, and donated them as *gifts of land*. Donors can enjoy the peace of mind that comes with the knowledge that the land's natural values will be perennially protected against destructive change.

Similarly, individuals may donate funds for the *purchase* of land to be designated as a natural area. These individuals will likewise know the satisfaction of having helped insure the protection of North Carolina's outstanding natural lands.

If a landowner wishes to retain ownership, yet be assured that the property will remain in its natural condition, conservation *easements* may be considered. Easements merely limit land use to activities compatible with natural area preservation.

A recent example of cooperation between agencies to preserve significant land has been the



RHODODENDRON



CAROLINA LILY



CARDINAL FLOWER

acquisition of 4,500 acres in Wilkes and Alleghany counties. Assisted by The Nature Conservancy, some 367 acres were transferred to the National Park Service for the Blue Ridge Parkway, while the remainder of the property, mixed hardwood forest teeming with mountain wildlife, was transferred to the State of North Carolina as a major addition to the Stone Mountain State Park.



WHITE OAK CREEK

Your Involvement

The North Carolina Natural Heritage Program must rely upon information from a wide variety of sources to continue its ongoing inventory. Concerned citizens are encouraged to make suggestions which could assist the Heritage staff in its task. Is there an area you feel should be saved? Do you know where a habitat for a threatened species exists? Contact the Heritage program so that the information can be verified and incorporated.

As the inventory progresses field surveys are required, for which naturalists, advanced science classes, and other qualified groups are welcome to volunteer as field surveyors. Group leaders and teachers should inquire about areas needing field investigation. Volunteers can also usefully contribute to many other phases of the program.

Your support is needed to assure that North Carolina's outstanding natural diversity is preserved for generations to come. You are invited to join the North Carolina Nature Conservancy, which is now being formed. If you are a member of a group or club that is interested in learning more about Heritage, a representative will be happy to make a presentation or supply more information. Those who are interested in learning more about various means of land protection are also invited to contact the Heritage staff.

Ultimately, the people of North Carolina are the guardians of their state's rich natural resources. Please support the Natural Heritage Program as a step toward the preservation of your heritage.



11

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APPENDIX B

Conservation Easement handbook

Lance Peacock
Charles Roe

Illustrations by Jenny Nygard



CONSERVATION EASEMENTS

To Preserve North Carolina's Heritage

A handbook for North Carolina property owners, explaining the potentials and advantages of conservation easements; was written as a voluntary project of staff of the Natural Heritage Program. The 30-page booklet was sponsored by state conservation organizations. Copies are available from the sponsoring groups.

CONSERVATION EASEMENTS

To Preserve North Carolina's Heritage

A booklet for North Carolina's citizens, explaining the importance of
conservation easements and how they can be used to protect the state's
natural resources. The booklet is available in English and Spanish.
Conservation easements are a voluntary way to protect the state's
natural resources.

This booklet is co-sponsored by the following organizations,
working to preserve North Carolina's natural lands and critical
habitats.

Association for the Preservation of the Eno River Valley

Conservation Foundation of North Carolina

Department of Natural and Economic Resources

Division of Parks and Recreation

National Committee to Save the New River

New Hope Chapter, National Audubon Society

North Carolina Botanical Garden and
the Botanical Garden Foundation

North Carolina Nature Conservancy

North Carolina Wild Flower Preservation Society

APPENDIX C

MANAGED AREAS

FEDERAL

I. Department of Agriculture

- A. Soil Conservation Service
 - 1. Benchmark Soil Series

- B. U.S. Forest Service
 - General

- 1. National Forests
 - a. Croatan
 - b. Nantahala
 - c. Pisgah
 - d. Uwharrie

Special Interest Areas

- 1. Experimental Forests
 - a. Bent Creek
 - b. Coweeta
 - c. Southeastern Forest Experiment Station
 - 2. Municipal Watersheds
 - 3. Research Natural Areas
 - a. Bryson Branch Falls and Cove
 - b. Catfish Lake
 - c. Great Lake
 - d. Kelsey Tract
 - e. Middle Creek (Black Mountain)
 - f. Piney Knob Fork
 - g. Walker Cove
 - h. Walking Fern Cove
 - i. White Oak River Swamp
 - 4. Scenic Special Interest Areas
 - a. Big Lost Cove Cliffs
 - b. Craggy Mountain
 - c. Dismal Falls (proposed)
 - d. Glen's Falls
 - e. John Rock
 - f. Looking Glass Rock
 - g. Waterfall Creek
 - h. Whitewater Falls
 - 5. Zoological, Botanical and other Special Interest Areas
 - a. Blowing Spring Marble Bluffs
 - b. Cradle of Forestry/Pink Beds Bogs
 - c. Perry Gap Hemlock Cove
 - d. Silver Run Creek Flatwoods
 - e. Terrapin Mountain
 - 6. Wild Areas
 - a. Indian Creek
 - b. Santeetlah Creek
 - c. Snowbird Creek
 - d. South Fork Mills River

7. Wild Rivers
 - a. Chattooga
8. Wilderness
 - a. Ellicott Rock
 - b. Joyce Kilmer/Slickrock
 - c. Linville Gorge
 - d. Shining Rock
9. Wilderness - proposed
 - a. Cheoah Bald
 - b. Craggy Mountain
 - c. Harper Creek
 - d. Kilmer - Slickrock Extension
 - e. Linville Gorge Extension
 - f. Pocosin Bog
 - g. Shining Rock Extension
 - h. Snowbird Creek
 - i. Standing Indian

II. Department of Defense

- A. Army Corps of Engineers
 1. Falls of the Neuse Reservoir
 2. Eagle Island Wildlife Management Area
- B. Everett Jordan Reservoir - proposed
- C. Fort Bragg Army Base
- D. Camp Lejeune Marine Corps Base

III. Department of the Interior

- A. Fish and Wildlife Service
 1. National Wildlife Refuges
 - a. Cedar Island
 - b. Dismal Swamp
 - c. Mackay Island
 - d. Mattamuskeet
 - e. Pea Island
 - f. Pee Dee
 - g. Pungo
 - h. Swanquarter
 2. Natural Areas
 - a. Pocosin
 - b. Salyer's Ridge
 3. Wilderness
 - a. Pea Island
 4. Wilderness - proposed
 - a. Cedar Island
 - b. Mattamuskeet
 - c. Swanquarter
- B. US Geological Survey
 1. Hydrologic Bench Marks
 - a. Cataloochee Creek
- C. National Park Service
 1. National Natural Landmarks
 - a. Green Swamp
 - b. Long Hope Creek Spruce Bog

- c. Mount Jefferson State Park
- d. Mount Mitchell State Park
- e. Nags Head Woods/Jockey's Ridge
- f. Piedmont Beech - Umstead State Park
- g. Pilot Mountain State Park
- h. Stone Mountain State Park
- 2. National Parks
 - a. Great Smoky Mountains
- 3. National Scenic Highways
 - a. Blue Ridge Parkway
- 4. National Seashores
 - a. Cape Hatteras
 - b. Cape Lookout
- 5. Wilderness Areas - proposed

V. Tennessee Valley Authority

A. Fontana Lake

B. Hiwassee, Appalachia, and Chatuge Lakes

1. The first part of the report
deals with the general situation
of the country and the
state of the economy.
It is a very interesting
and informative study
of the country and its
people.

2. The second part of the report
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country.

- 3. The third part of the report
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MANAGED AREAS

STATE

- I. Department of Administration
 - A. Bushy Lake
- II. Department of Agriculture
 - A. Butner
- III. Department of Cultural Resources
 - A. Division of Archives and History
 - 1. State Historic sites
 - a. Reed Gold Mine
 - b. Fort Fisher
 - c. Town Creek Indian Mound
 - d. Brunswick Town
 - e. Fort Dobbs
 - f. Bentonville Battlefield
 - g. Alamance Battlefield
 - h. Duke Homestead
 - i. Bennett Place
 - j. House in the Horseshoe
 - k. Somerset Place
- IV. Department of Education
- V. Department of Natural and Economic Resources
 - A. Division of Forest Resources
 - 1. Small State Forests
 - a. Clayton
 - b. Holmes
 - c. Linville
 - d. Tuttle
 - 2. State Forests
 - a. Bladen Lake
 - 3. State Forest Natural Areas
 - a. Turkey Oak
 - B. Division of Parks and Recreation
 - 1. Natural Areas and Preserves
 - a. Weymouth Woods
 - b. Roosevelt
 - c. Mitchell's Mill
 - 2. Natural and Scenic Rivers
 - a. Linville River
 - b. New River, South Fork

3. State Parks
 - a. Baytree Lake
 - b. Boones Cave
 - c. Carolina Beach
 - d. Chowan Swamp
 - e. Cliffs of the Neuse
 - f. Crowder's Mountain
 - g. Dismal Swamp
 - h. Eno River
 - i. Fort Macon
 - j. Goose Creek
 - k. Hammocks Beach
 - l. Hanging Rock
 - m. Jockey's Ridge
 - n. Jones Lake
 - o. Lake Waccamaw
 - p. Masonboro Island
 - q. Medoc Mountain
 - r. Merchants Millpond
 - s. Morrow Mountain
 - t. Mount Jefferson
 - u. Mount Mitchell
 - v. Pettigrew
 - w. Pilot Mountain
 - x. Raven Rock
 - y. Singletary Lake
 - z. South Mountain
 - aa. Stone Mountain
 - bb. White Lake
 - cc. William B. Umstead
4. State Recreation Areas
 - a. Duke Power
 - b. Kerr Lake
5. State Zoological Park
- C. Wildlife Resources Commission
 1. Gamelands
 - a. Angola Bay
 - b. Caswell
 - c. Goose Creek
 - d. Green River
 - e. Gull Rock
 - f. Holly Shelter
 - g. North River
 - h. Northwest River
 - i. Sandhills
 - j. South Mountain
 - k. Thurmond Chatham
 2. Leased Gamelands

MANAGED AREAS

OTHER

I. Society of American Foresters

A. Natural Areas

1. Black Mountain
2. Chowan River
3. Duke Forest
4. Great Lake
5. Hemlock Bluffs
6. Hill Forest
7. Hofmann Forest Cypress
8. Kelsey Tract
9. Little Santeelah
10. Milltail Creek
11. Nere Elexus Day (Hofmann) Pond Pine
12. North Fork
13. Piedmont Beech
14. Piney Knob Fork
15. Rocky River White Pine
16. Rough Creek
17. Salyer's Ridge
18. Schenck Forest
19. Three Forks
20. Turkey Oak
21. Upper Piedmont Research Station
22. Walker Cove
23. Windy Falls

II. University - Private

A. Duke Forest

III. NC Botanical Foundation

IV. Highlands Biological Station

- A. Rebecca Bridger Tract
- B. Frank R. Dulany Bog
- C. W. C. Coker Rhododendron Trail
- D. Margaret Cannon Howell Wildlife Refuge

- V. University of North Carolina
 - A. Agriculture Experiment Stations
 - B. Forests-General
 - C. Goodwin Forest
 - D. Hill Forest
 - E. Hofmann Forest
 - F. Schenck Forest
 - G. Walcott Track
 - H. UNC-C Wildlife Preserve
 - I. Rocky River (Morgan's) Bluff

- VI. Private Preserves
 - A. Orton Plantation
 - B. Tryon Gardens - Pearson's Falls

- VII. Municipal Government

- VIII. The Nature Conservancy

APPENDIX D

NC CLASSIFICATION SYSTEM

SPECIAL ANIMAL SPECIES

10.000 Endangered

11.000 Mollusks

11.740	<i>Lioplax subcarinata</i>	Waccamaw scavenger
11.741	<i>Amnicola species</i>	Waccamaw snail
11.049	<i>Mesodon jonesianus</i>	Newfound Gap helix
11.750	<i>Canthyria species</i>	Tar River Spiny Mussel
11.565	<i>Carunculina pulla</i>	Savannah shoremussel
11.752	<i>Elliptio marsupiobesa</i>	Cape Fear spike
11.755	<i>Elliptio waccamawensis</i>	Waccamaw spike
11.757	<i>Lampsilis radiata</i>	Waccamaw mucket
	complex	(Lake Waccamaw population)
11.759	<i>Prolasmidonta heterodon</i>	Ancient floater

12.000 Arthropods

13.000 Invertebrates (Other)

14.000 Fishes

14.073	<i>Acipenser fulvescens</i>	Lake sturgeon
14.259	<i>Polyodon spathula</i>	Paddlefish
14.157	<i>Hiodon tergisus</i>	Mooneye
14.098	<i>Esox masquinongy</i>	Muskellunge
14.197	<i>Notropis bifrenatus</i>	Bridle shiner
14.154	<i>Fundulus waccamensis</i>	Waccamaw killifish
14.179	<i>Menidia extensa</i>	Waccamaw silverside
14.122	<i>Etheostoma jessiae</i>	Blueside darter
14.132	<i>Etheostoma perlongum</i>	Waccamaw darter
14.241	<i>Percina burtoni</i>	Blotchside logperch
14.245	<i>Percina macrocephala</i>	Longhead darter
14.072	<i>Acipenser brevirostrum</i>	Shortnose sturgeon

15.000 Amphibians

SPECIAL ANIMAL SPECIES - Continued

16.000 Reptiles

16.308	Alligator mississippiensis	American Alligator
16.310	Caretta caretta caretta	Atlantic Loggerhead
16.312	Chelonia mydas mydas	Atlantic Green Turtle
16.320	Dermochelys coriacea coriacea	Atlantic Leatherback
16.323	Eretmochelys imbricata imbricata	Atlantic Hawksbill
16.338	Lepidochelys kemp	Atlantic Ridley
16.318	Crotalus adamanteus	Eastern Diamondback Rattlesnake

17.000 Birds

17.440	Pelecanus occidentalis	Brown Pelican
17.416	Haliaeetus leucocephalus	Bald Eagle
17.408	Falco peregrinus	Peregrine Falcon
17.394	Dendrocopus borealis	Red-cockaded Woodpecker

18.000 Mammals

18.476	Felis concolor	Mountain Lion
18.498	Myotis sodalis	Indiana bat
18.523	Trichechus manatus	Manatee

20.000 Threatened

21.000 Mollusks

21.743	Helisoma magnificum	Cape Fear ramshorn
21.746	Mesodon clarki nantahala	Noonday helix
21.748	Triodopsis soelneri	Waccamaw helix
21.753	Elliptio species	Waccamaw lance
21.570	Fusconaia masoni	Atlantic pigtoe

22.000 Arthropods

22.011	Cambarus chasmodactylus	New River crayfish
22.708	Cambarus catagius	
22.709	Procambarus lepidodactylus	
22.710	Anillinus species (A)	

SPECIAL ANIMAL SPECIES - Continued

23.000 Invertebrates (Other)

24.000 Fishes

24.255	Phenacobius teretulus	Kanawha minnow
24.228	Noturus gilberti	Orange-fin madtom
24.124	Etheostoma kanawhae	Kanawha darter
24.242	Percina caprodes	Logperch

25.000 Amphibians

25.297	Plethodon longicrus	Crevice Salamander
25.287	Hyla andersoni	Pine Barrens Treefrog

26.000 Reptiles

26.315	Clemmys muhlenbergi	Bog Turtle
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27.000 Birds

27.369	Anhinga anhinga	Anhinga
27.442	Phalacrocorax auritus floridanus	Double-crested Cormorant
27.422	Ixobrychus exilis	Least Bittern
27.381	Cathartes aura	Turkey Vulture
27.391	Coragyps atratus	Black Vulture
27.361	Accipiter cooperi	Cooper's Hawk
27.362	Accipiter striatus	Sharp-shinned Hawk
27.370	Aquila chrysaetos	Golden Eagle
27.375	Buteo lineatus	Red-shouldered Hawk
27.407	Falco columbarius	Merlin
27.409	Falco sparverius	American Kestrel
27.363	Aegolius acadicus	Saw-whet Owl
27.432	Nuttallornis borealis	Olive-sided Flycatcher
27.437	Parus atricapillus	Black-capped Chickadee
27.383	Certhia familiaris	Brown Creeper
27.463	Thryomanes bewickii	Bewick's Wren
27.469	Vireo gilvus	Warbling Vireo
27.395	Dendroica cerulea	Cerulean Warbler
27.364	Aimophila aestivalis	Bachman's Sparrow

SPECIAL ANIMAL SPECIES - Continued

28.000 Mammals

28.477 *Glaucomys sabrinus* Northern Flying Squirrel

30.000 Special Concern

31.000 Mollusks

31.006	<i>Busycon canaliculatum</i>	Channeled Whelk
31.007	<i>Busycon carica</i>	Knobbed Whelk
31.008	<i>Busycon contrarium</i>	Lightning Whelk
31.020	<i>Detracia clarki</i>	Clark's Melampus
31.050	<i>Neritina usnea</i> (<i>Neritina reclivata</i>)	Olive Nerite
31.004	<i>Argopecten gibbus</i>	Calico Scallop
31.052	<i>Panopea bitruncata</i>	Atlantic Geoduck
31.053	<i>Paramya subovata</i>	Subovate Soft Clam
31.563	<i>Alasmidonta varicosa</i>	Brook floater
31.564	<i>Anodonta couperiana</i>	Barrel floater
31.751	<i>Elliptio lanceolata</i>	Yellow lance
31.756	<i>Lampsilis ochracea</i>	Tidewater mucket
31.573	<i>Villosa constricta</i>	Notched rainbow

32.000 Arthropods

Crayfishes

32.711 *Cambarus reburus*
32.712 *Orconectes virginianus*

Amphipods

32.713 *Stygobromus* species (A)
32.714 *Stygobromus* species (B)

Isopods

32.715 *Miktoniscus alabamensis*

Millipeds

32.716 *Dixioria dactylifera*

Scorpions

32.717 *Vejovis carolinianus*

Spiders

32.718	<i>Microhexura mortivagus</i>	Mount Mitchell spider
32.719	<i>Ivesia carolinensis</i>	Linville Caverns spider

SPECIAL ANIMAL SPECIES - Continued

Odonata

32.720 Tachopterix thoreyi

Scorpion flies

32.721 Brachypanorpa caroliniensis

Hymenoptera

32.722 Coelioxys hunteri

32.723 Formica exectoides

32.724 Stigmatomma species

Cicindelid beetles

32.725 Cicindela ancocisconensis

Pselaphid beetles

Arianops species (15)

Scarab beetles

32.726 Lichnanthe species (A)

32.727 Aphodias species (A)

Circulionid beetles

32.728 Tychius daggyi

Carabid beetles

Trechus species (15)

32.729 Anillinus species

Stylus species (6)

32.730 Scaphinotus species

Maronetus species (6)

32.731 Pterostichus palmi

32.732 Pterostichus lubricus

Lepidoptera

32.733 Problema bulenta

Rare skipper

32.734 Mitoura hesseli

Hessel's hairstreak

32.735 Strymon ontario subspecies (A)

Northern hairstreak

32.736 Acrobasis feltella

32.737 Atheloca subrefella

32.738 Nephopterix dammersi floridensis

32.739 Noropsis hieroglyphica

33.000 Invertebrates (Other)

33.015 Chaetopterus variopedatus

Parchment Tube Worm

33.051 Notomastus lobatus

Polychaete Worm

33.069 Thalassema hartmani

Hartman's Echiurid Worm

SPECIAL ANIMAL SPECIES - Continued

34.000 Fishes

34.177	Lampetra lamottei	American brook lamprey
34.146	Exoglossum laurae	Tonguetied minnow
34.147	Exoglossum maxillingua	Cutlips minnow
34.166	Hybopsis monacha	Spotfin chub
34.167	Hybopsis rubrifrons	Rosyface chub
34.762	Hybopsis, new species (A)	
34.763	Hybopsis, new species (B)	
34.189	Nocomis leptcephalus interocularis	Bluehead chub
34.191	Nocomis platyrhynchus	Bigmouth chub
34.213	Notropis rubellus	Rosyface shiner
34.210	Notropis mekistocholas	Cape Fear shiner
34.214	Notropis scabriceps	New River shiner
34.258	Pimephales notatus	Bluntnose minnow
34.265	Semotilus, new species	
34.083	Carpiodes carpio	River carpsucker
34.168	Hypentelium roanokense	Roanoke hog sucker
34.184	Moxostoma ariommum	Bigeye jumprock
34.227	Noturus furiosus	Carolina madtom
34.764	Noturus, new species (A)	
34.076	Ambloplites cavirostris	Roanoke bass
34.181	Micropterus coosae	Redeye bass
34.183	Micropterus punctulatus	Spotted bass
34.117	Etheostoma collis	Carolina darter
34.121	Etheostoma inscriptum	Turquoise darter
34.128	Etheostoma maculatum	Spotted darter
34.129	Etheostoma mariae	Pinewoods darter
34.133	Etheostoma podostemone	Riverweed darter
34.140	Etheostoma thalassinum	Seagreen darter
34.239	Percina aurantiaca	Tangerine darter
34.246	Percina maculata	Blackside darter
34.247	Percina oxyrhyncha	Sharpnose darter
34.250	Percina sciera	Dusky darter
34.251	Percina squamata	Olive darter
34.152	Fundulus confluentus	Marsh killifish
34.153	Fundulus luciae	Spotfin killifish
34.082	Blennius marmoreus	Seaweed blenny
34.169	Hypoleurochilus geminatus	Crested blenny
34.170	Hypsoblennius ionthas	Freckled blenny
34.093	Dormitator maculatus	Fat sleeper
34.095	Eleotris pisonis	Spinycheek sleeper
34.145	Evorthodus lyricus	Lyre goby
34.074	Acipenser oxyrhynchus	Atlantic sturgeon

SPECIAL ANIMAL SPECIES - Continued

35.000 Amphibians

35.271	Ambystoma talpoideum	Mole Salamander
35.274	Aneides aeneus	Green Salamander
35.276	Cryptobranchus a. alleganiensis	Hellbender
35.282	Eurycea longicauda longicauda	Long-tailed Salamander
35.292	Necturus lewisi	Neuse River Waterdog
35.300	Plethodon welleri	Weller's Salamander
35.303	Rana areolata capito	Carolina Gopher Frog

36.000 Reptiles

36.324	Eumeces anthracinus anthracinus	Northern Coal Skink
36.336	Lampropeltis getulus sticticeps	Outer Banks Kingsnake
36.343	Micrurus fulvius fulvius	Eastern Coral Snake

37.000 Birds

37.435	Pandion haliaetus	Osprey
37.392	Corvus corax	Common Raven

38.000 Mammals

38.524	Ursus americanus	Black bear
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40.000 Undetermined

41.000 Mollusks

41.742	Spirodon dilatata	Kanawha riversnail
41.745	Anguispira paucicostata	Mount Mitchell snail
41.748	Mesodon archeri	Cherokee helix
41.747	Mesodon orestes	Avenger helix
41.562	Alasmidonta triangulata	Triangle floater
41.749	Anodonta implicata	Alewite floater
41.754	Elliptio species (B)	File spike
41.758	Ligumia nasuta	Eastern pondmussel

42.000 Arthropods

SPECIAL ANIMAL SPECIES - Continued

43.000 Invertebrates (Other)

44.000 Fishes

45.000 Amphibians

45.272	Ambystoma tigrinum tigrinum	Eastern Tiger Salamander
45.286	Hemidactylium scutatum	Four-toed Salamander
45.293	Necturus maculosus maculosus	Mudpuppy
45.295	Plethodon dorsalis dorsalis	Zig zag Salamander
45.299	Plethodon wehrlei	Wehrle's Salamander
45.301	Pseudacris brachyphona	Mountain Chorus Frog

46.000 Reptiles

46.360	Trionyx spiniferus spiniferus	Eastern Spiny Softshell
46.349	Natrix sipedon williamengelsi	Carolina Salt Marsh Snake
46.350	Opheodrys vernalis vernalis	Eastern Smooth Green Snake

47.000 Birds

48.000 Mammals

48.487	Microsorex hoyi winnemana	Pygmy Shrew
48.513	Sorex dispar blitchi	Long-tailed Shrew
48.515	Sorex longirostris fisheri	Southeastern Shrew
48.516	Sorex palustris punctulatus	Water Shrew
48.501	Parascalops breweri	Hairy-tailed Mole
48.483	Lasiurus seminolus	Seminole Bat
48.494	Myotis grisescens	Gray Myotis
48.495	Myotis keeni	Keen's Myotis
48.496	Myotis subulatus	Small-footed Myotis
48.497	Myotis lucifugus	Little Brown Myotis
48.519	Sylvilagus transitionalis	New England Cottontail
48.510	Sciurus niger	Eastern Fox Squirrel
48.488	Microtus chrotorrhinus	Rock Vole
48.490	Microtus pennsylvanicus nigrans	Meadow Vole
48.500	Neotoma floridana	Eastern Woodrat
48.520	Synaptomys cooperi	Bog Lemming
48.492	Mustela nivalis allegheniensis	Least Weasel
48.506	Plecotus rafinesqueii	Rafinesque's Big-Eared Bat

SPECIAL ANIMAL SPECIES - Continued

50.000 Extirpated

51.000 Mollusks

51.744 Planorbis eucosmius Greenfield ramshorn

52.000 Arthropods

53.000 Invertebrates (Other)

54.000 Fishes

54.223	Noturus eleutherus	Mountain Madtom
54.109	Etheostoma acuticeps	Sharphead darter
54.137	Etheostoma simoterum	Tennessee snubnose darter

55.000 Amphibians

56.000 Reptiles

57.000 Birds

58.000 Mammals

SPECIAL PLANT SPECIES

10.000 Endangered Plants (Endemic, throughout, and disjunct)

13.060	<i>Asplenium heteroresiliens</i>	Carolina spleenwort fern
13.061	<i>Asplenium monanthes</i>	Single-sorus spleenwort fern
13.209	<i>Cystopteris x tennesseensis</i>	Tennessee Bladder fern
13.295	<i>Grammitis nimbata</i>	Dwarf polypody fern
13.479	<i>Pellaea x wrightiana</i>	Wright's cliff-brake fern
14.048	<i>Arenaria godfreyi</i>	Godfrey's sandwort
14.050	<i>Arenaria uniflora</i>	Single-flowered sandwort
14.080	<i>Betula papyrifera</i> var. <i>cordifolia</i>	Mountain paper birch
14.087	<i>Buckleya distichophylla</i>	Piratebush
14.090	<i>Cacalia rugelia</i>	Rugel's ragwort
14.108	<i>Carex aenea</i>	Fernald's hay sedge
14.112	<i>Carex biltmoreana</i>	Biltmore sedge
14.127	<i>Carex misera</i>	Wretched sedge
14.131	<i>Carex purpurifera</i>	Purple sedge
14.181	<i>Coreopsis latifolia</i>	Broadleaf coreopsis
14.210	<i>Dalibarda repens</i>	Robin-run-away
14.285	<i>Geum geniculatum</i>	Bent avens
14.287	<i>Geum radiatum</i>	Spreading avens
14.291	<i>Glyceria nubigena</i>	Smoky-mountain mannagrass
14.329	<i>Hexastylis contracta</i>	Mountain heart leaf
14.331	<i>Hexastylis naniflora</i>	Dwarf-flowered heart leaf
14.338	<i>Hudsonia montana</i>	Mountain golden heather
14.363	<i>Isotria medeoloides</i>	Small whorled pogonia
14.370	<i>Juncus trifidus</i> var. <i>monanthos</i>	One-flowered rush
14.372	<i>Kalmia cuneata</i>	White wicky
14.396	<i>Lilaeopsis carolinensis</i>	Carolina lilaeopsis
14.400	<i>Lindera melissaefolia</i>	Southern spicebush
14.406	<i>Listera cordata</i>	Heart-leaved twayblade
14.430	<i>Lysimachia asperulaefolia</i>	Rough-leaf loosestrife
14.527	<i>Plantago cordata</i>	Heart-leaf plantain
14.529	<i>Poa languida</i>	Torrey bluegrass
14.542	<i>Portulaca smallii</i>	Small's portulaca
14.564	<i>Pyxidanthra barbulata</i> var. <i>brevifolia</i>	Wells pyxie-moss
14.575	<i>Ranunculus subcordatus</i>	Bladen buttercup
14.617	<i>Sagittaria fasciculata</i>	Bunched arrowhead
14.631	<i>Saxifraga caroliniana</i>	Carolina saxifrage
14.641	<i>Scirpus flaccidifolius</i>	Reclining bulrush
14.654	<i>Sedum pusillum</i>	Puck's orpine
14.655	<i>Sedum rosea</i>	Roseroot
14.658	<i>Senecio millefolium</i>	Divided-leaf groundsel
14.666	<i>Shortia galacifolia</i>	Oconee bells
14.678	<i>Solidago pulchra</i>	Carolina goldenrod
14.682	<i>Solidago spithamea</i>	Blue-ridge goldenrod
14.685	<i>Solidago verna</i>	Spring-flowering goldenrod
14.693	<i>Sporobolus heterolepis</i>	Prairie dropseed
14.714	<i>Thalictrum cooleyi</i>	Cooley's meadowrue
14.737	<i>Trisetum spicatum</i> var. <i>molle</i>	Soft trisetum

SPECIAL PLANT SPECIES - Continued

20.000 Endangered Plants (At Periphery of Range)

23.004	<i>Adiantum capillus-veneris</i>	Venus-hair fern
23.057	<i>Asplenium bradleyi</i>	Bradley's spleenwort
23.065	<i>Asplenium ruta-muraria</i>	Wall-rue spleenwort
23.082	<i>Botrychium lanceolatum</i>	Lance-leaf grapefern
23.084	<i>Botrychium matricariaefolium</i>	Marticary grapefern
23.150	<i>Cheilanthes alabamensis</i>	Alabama lip-fern
23.296	<i>Gymnocarpium dryopteris</i>	Common caffer
23.468	<i>Ophioglossum petiolatum</i>	Stalked adder's tongue
23.720	<i>Thelypteris phegopteris</i>	Northern beech-fern
23.726	<i>Trichomanes boschianum</i>	Bristle fern
23.727	<i>Trichomanes petersii</i>	Dwarf filmy-fern
23.759	<i>Woodsia ilvensis</i>	Rusty woodsia
24.002	<i>Aconitum reclinatum</i>	Trailing wolfsbane
24.006	<i>Adlumia fungosa</i>	Climbing fumatory
24.007	<i>Agalinis aphylla</i>	Scale leaf gerardia
24.009	<i>Agalinis maritima</i>	Saltmarsh gerardia
24.010	<i>Agalinis tenella</i>	Pineland gerardia
24.011	<i>Agalinis virgata</i>	Branched gerardia
24.015	<i>Agropyron trachycaulum</i>	Slender wheatgrass
24.016	<i>Agrostis borealis</i>	Arctic bent grass
24.024	<i>Ammannia teres</i>	Quill ammannia
24.025	<i>Amorpha georgiana</i>	Georgian amorpha
24.031	<i>Aneilema nudiflorum</i>	Aneilema
24.032	<i>Anemone caroliniana</i>	Carolina windflower
24.034	<i>Angelica atropurpurea</i>	Purplestem angelica
24.042	<i>Arabis glabra</i>	Tower mustard
24.043	<i>Arabis laevigata</i> var. <i>burkii</i>	Smooth rockcress
24.045	<i>Arabis patens</i>	Spreading rockcress
24.051	<i>Arethusa bulbosa</i>	Bog rose
24.056	<i>Asclepias pedicellata</i>	Stalked milkweed
24.067	<i>Aster carolinianus</i>	Carolina aster
24.068	<i>Aster laevis</i>	Smooth aster
24.075	<i>Bacopa cyclophylla</i>	Roundleaf water-hyssop
24.088	<i>Bumelia tenax</i>	Tough bumelia
24.091	<i>Cacalia suaveolens</i>	Sweet indian-plantain
24.096	<i>Callicarpa dichotoma</i>	Purple beauty berry
24.097	<i>Caltha palustris</i>	Marsh marigold
24.099	<i>Calystegia sericata</i>	Blue-ridge bindweed
24.101	<i>Campanula aparinoides</i>	Bed straw bellflower
24.103	<i>Cardamine angustata</i> var. <i>multifida</i>	Divided toothwort
24.104	<i>Cardamine douglassii</i>	Douglass bittercress
24.106	<i>Cardamine rotundifolia</i>	Mountain watercress
24.109	<i>Carex arenaria</i>	Sand sedge
24.111	<i>Carex barrattii</i>	Barratt's sedge
24.113	<i>Carex buxbaumii</i>	Buxbaum sedge
24.114	<i>Carex canescens</i> var. <i>disjuncta</i>	Silvery sedge
24.116	<i>Carex cherokeensis</i>	Cherokee sedge
24.117	<i>Carex collinsii</i>	Collins' sedge
24.118	<i>Carex conoidea</i>	Cone-shaped sedge

SPECIAL PLANT SPECIES - Continued

24.119	<i>Carex cristatella</i>	Small-crested sedge
24.120	<i>Carex decomposita</i>	Cypress knee sedge
24.121	<i>Carex divisa</i>	Divided sedge
24.122	<i>Carex eburnea</i>	Bristle-leaved sedge
24.123	<i>Carex exilis</i>	Meagre sedge
24.125	<i>Carex jamesii</i>	James sedge
24.130	<i>Carex projecta</i>	Projecting sedge
24.132	<i>Carex reniformis</i>	Kidney sedge
24.133	<i>Carex schweinitzii</i>	Schweinitz' sedge
24.136	<i>Carex tenax</i>	Strong sedge
24.135	<i>Carex tetanica</i>	Rigid sedge
24.137	<i>Carex trisperma</i>	Three-seeded sedge
24.138	<i>Carex turgescens</i>	Swollen sedge
24.139	<i>Carex woodii</i>	Wood's sedge
24.140	<i>Carya myristicaeformis</i>	Nutmeg Hickory
24.156	<i>Chrysoma pauciflosculosa</i>	Chrysoma
24.157	<i>Chrysosplenium americanum</i>	Golden saxifrage
24.168	<i>Clematis glaucophylla</i>	Leather flower
24.169	<i>Clematis verticillaris</i>	Rock clematis
24.172	<i>Commelina caroliniana</i>	Carolina dayflower
24.180	<i>Coreopsis gladiata</i>	Swamp tickweed
24.185	<i>Cornus racemosa</i>	Gray dogwood
24.191	<i>Croton monanthogynus</i>	Prairie-tea croton
24.195	<i>Cynanchum laeve</i>	Smooth swallowwort
24.199	<i>Cyperus dentatus</i>	Toothleaf flatsedge
24.201	<i>Cyperus lecontei</i>	LeConte's flatsedge
24.203	<i>Cyperus virens</i>	Green flatsedge
24.206	<i>Cypripedium reginae</i>	Showy lady's-slipper
24.214	<i>Deschampsia caespitosa</i> var. <i>glauc</i>	Tufted hair grass
24.216	<i>Dicentra eximia</i>	Bleeding heart
24.218	<i>Diervilla lonicera</i>	Common bush-honeysuckle
24.227	<i>Draba ramosissima</i>	Branching draba
24.228	<i>Draba reptans</i>	Creeping draba
24.230	<i>Drosera filiformis</i>	Threadleaf sundew
24.238	<i>Echinacea pallida</i>	Purple cone-flower
24.243	<i>Elatine triandra</i>	Waterwort
24.774	<i>Eleocharis cellulosa</i>	Gulfcoast spikerush
24.244	<i>Eleocharis halophila</i>	Salt spike-rush
24.245	<i>Eleocharis montevidensis</i>	Sand spike-rush
24.246	<i>Eleocharis robbinsii</i>	Robbins' spike-rush
24.252	<i>Epidendrum conopseum</i>	Green-fly orchid
24.255	<i>Epilobium ciliatum</i>	Purpleleaf willowherb
24.256	<i>Epilobium leptophyllum</i>	Narrowleaf willowherb
24.264	<i>Eulophia ecristata</i>	Eulophia orchid
24.265	<i>Euonymus atropurpureus</i>	Eastern wahoo
24.269	<i>Euphorbia purpurea</i>	Purple spurge
24.270	<i>Filipendula rubra</i>	Prairie meadowsweet
24.274	<i>Fothergilla major</i>	Large fothergilla
24.279	<i>Gelsimium rankinii</i>	Rankin's yellow jessamine
24.281	<i>Gentiana alba</i>	White gentian
24.283	<i>Gentiana crinita</i>	Fringed gentian
24.284	<i>Geum aleppicum</i>	Aleppo avens

SPECIAL PLANT SPECIES - Continued

24.286	<i>Geum laciniatum</i>	Torn avens
24.288	<i>Geum vernum</i>	Early avens
24.289	<i>Gillenia stipulata</i>	Indian physic
24.308	<i>Helenium pinnatifidum</i>	Dissected sneezeweed
24.309	<i>Helianthemum bicknellii</i>	Bicknell's frostweed
24.310	<i>Helianthemum propinquum</i>	Creeping sunrose
24.314	<i>Helianthus laevigatus</i>	Smooth sunflower
24.317	<i>Hemicarpha micrantha</i>	Small-flowered hemicarpha
24.320	<i>Heteranthera dubia</i>	Waterstar mudphantain
24.322	<i>Heterotheca pilosa</i>	Hairy telegraphplant
24.325	<i>Heuchera longiflora</i> var. <i>aceroides</i>	Maple-leaf alumroot
24.327	<i>Heuchera pubescens</i>	Marbled alumroot
24.339	<i>Hudsonia tomentosa</i>	Wooly beach heather
24.348	<i>Hypericum adpressum</i>	Shore St. John's-wort
24.351	<i>Hypericum frondosum</i>	Golden St. John's-wort
24.362	<i>Isopyrum bitematum</i>	Atlantic isopyrum
24.365	<i>Jeffersonia diphylla</i>	Twin leaf
24.384	<i>Lechea torreyi</i>	Torrey's pinweed
24.386	<i>Lepuropetalon spathulatum</i>	Dwarf saxifrage
24.392	<i>Liatris aspera</i>	Rough gayfeather
24.393	<i>Liatris earlei</i>	Earle's gayfeather
24.395	<i>Liatris turgida</i>	Turgid gayfeather
24.399	<i>Limosella subulata</i>	Awl-leaf mudwort
24.404	<i>Liparis loeselii</i>	Fen orchid
24.405	<i>Listera australis</i>	Southern twayblade
24.407	<i>Lithospermum canescens</i>	Hoary puccoon
24.409	<i>Litsea aestivalis</i>	Pondspice
24.411	<i>Lonicera canadensis</i>	American fly-honeysuckle
24.413	<i>Lonicera flava</i>	Yellow honeysuckle
24.414	<i>Lophiola americana</i>	Golden crest
24.415	<i>Ludwigia alata</i>	Winged seedbox
24.417	<i>Ludwigia lanceolata</i>	Lanceleaf seedbox
24.418	<i>Ludwigia linifolia</i>	Flaxleaf seedbox
24.419	<i>Ludwigia microcarpa</i>	Tinyfruited seedbox
24.421	<i>Ludwigia repens</i>	Creeping marshpurslane
24.428	<i>Lycopus cokeri</i>	Coker's bugleweed
24.431	<i>Lysimachia fraseri</i>	Fraser's loosestrife
24.433	<i>Macbridea caroliniana</i>	Carolina bogmint
24.438	<i>Malaxis spicata</i>	Florida adder's mouth
24.441	<i>Marshallia grandiflora</i>	Great marshallia
24.442	<i>Marshallia trinervia</i>	Three-veined marshallia
24.446	<i>Melica nitens</i>	Three flowered melic
24.448	<i>Menyanthes trifoliata</i>	Common bogbean
24.449	<i>Mertensia virginica</i>	Virginia cowslip
24.453	<i>Muhlenbergia glomerata</i>	Bristly muhly
24.464	<i>Oenothera perennis</i>	Perennial sundrops
24.465	<i>Onosmodium molle</i>	Soft marbleseed
24.476	<i>Pachysandra procumbens</i>	Alleghany spurge
24.481	<i>Panax trifolium</i>	Dwarf ginseng
24.485	<i>Panicum neuranthum</i>	Cord panic
24.487	<i>Panicum ovale</i>	Oval panic
24.489	<i>Parietaria floridana</i>	Florida pellitory
24.492	<i>Parnassia grandifolia</i>	Big leaved parnassia

SPECIAL PLANT SPECIES - Continued

24.498	<i>Pedicularis lanceolata</i>	Swamp lousewort
24.502	<i>Peplis diandra</i>	Water purslane
24.509	<i>Phacelia purshii</i>	Pursh phacelia
24.515	<i>Phlox subulata</i>	Moss phlox
24.528	<i>Plantago sparsiflora</i>	Fewflowered plantain
24.531	<i>Polemonium reptans</i>	Creeping polemonium
24.536	<i>Polygala paucifolia</i>	Fringed polygala
24.538	<i>Polygonella articulata</i>	Coast jointweed
24.540	<i>Ponthieva racemosa</i>	Shadow-witch
24.541	<i>Populus grandidentata</i>	Large-toothed aspen
24.546	<i>Potamogeton illinoensis</i>	Illinois pondweed
24.547	<i>Potamogeton natans</i>	Floatingleaf pondweed
24.553	<i>Prunus virginiana</i>	Choke cherry
24.557	<i>Psoralea onobrychis</i>	Lanceleaf scurfpea
24.559	<i>Ptilimnium costatum</i>	Ribbed mock-bishop's weed
24.571	<i>Quercus prinoides</i>	Dwarf chinquapin oak
24.572	<i>Ranunculus ambigens</i>	Waterplantain spearwort
24.573	<i>Ranunculus flabellaris</i>	Yellow crowfoot
24.574	<i>Ranunculus hederaceus</i>	Ivy buttercup
24.579	<i>Rhexia aristosa</i>	Awed meadow-beauty
24.580	<i>Rhexia cubensis</i>	Cuban meadow-beauty
24.581	<i>Rhexia virginica</i> var. <i>purshii</i>	Common meadow-beauty
24.588	<i>Rhododendrum roseum</i>	Election pink
24.600	<i>Rhynchospora alba</i>	White beakrush
24.601	<i>Rhynchospora breviseta</i>	Shortbristled beakrush
24.603	<i>Rhynchospora pleiantha</i>	Coastal beakrush
24.604	<i>Rhynchospora stenophylla</i>	Littleleaf beakrush
24.605	<i>Rhynchospora tracyi</i>	Tracy's beakrush
24.611	<i>Ruellia humilis</i>	Low ruellia
24.612	<i>Sabal palmetta</i>	Cabbage palmetto
24.613	<i>Sabatia dodecandra</i> var. <i>kennedyana</i>	Sea-pink
24.619	<i>Sagittaria montevidensis</i>	Giant arrowleaf
24.620	<i>Sagittaria teres</i>	Slender arrowhead
24.633	<i>Saxifraga pensylvanica</i>	Swamp saxifrage
24.636	<i>Schoenolirion croceum</i>	Sunnybell
24.637	<i>Schwalbea americana</i>	American chaffseed
24.638	<i>Scirpus acutus</i>	Hardstem bulrush
24.643	<i>Scirpus lineatus</i>	Lined bulrush
24.644	<i>Scirpus longii</i>	Long's bulrush
24.645	<i>Scirpus olneyi</i>	Olney's rush
24.646	<i>Scirpus subterminalis</i>	Swaying rush
24.648	<i>Scutellaria nervosa</i>	Veined skullcap
24.650	<i>Scutellaria parvula</i>	Small skullcap
24.651	<i>Scutellaria saxatilis</i>	Rock skullcap
24.659	<i>Senecio pauperculus</i>	Balsam groundsel
24.660	<i>Senecio robbinsii</i>	Robbin's groundsel
24.664	<i>Seymeria pectinata</i>	Sticky afzelia
24.673	<i>Silphium terebinthenaceum</i>	Prarie dock
24.680	<i>Solidago radula</i>	Stiffleaf goldenrod
24.681	<i>Solidago simulans</i>	Mimic goldenrod
24.683	<i>Solidago squarrosa</i>	Rugged goldenrod
24.686	<i>Sparganium chlorocarpum</i>	Greenfruit bur-reed
24.688	<i>Spiraea virginiana</i>	Virginia spiraea
24.689	<i>Spiranthes laciniata</i>	Lace-lip spiral-orchid

SPECIAL PLANT SPECIES - Continued

24.690	<i>Spiranthes longilabris</i>	Giant spiral-orchid
24.695	<i>Sporobolus virginicus</i>	Seashore dropseed
24.696	<i>Stellaria aquatica</i>	Water starwort
24.703	<i>Streptopus amplexifolius</i>	White mandarin
24.705	<i>Swertia caroliniensis</i>	Columbo
24.712	<i>Taxus canadensis</i>	Canada yew
24.718	<i>Thaspium pinnatifidum</i>	Mountain thaspium
24.723	<i>Tradescantia hirsuticaulis</i>	Hairy spiderwort
24.733	<i>Trillium discolor</i>	Hottled trillium
24.743	<i>Utricularia geminiscapa</i>	Two-flowered bladderwort
24.746	<i>Vaccinium macrocarpon</i>	Cranberry
24.754	<i>Viola tripartita</i>	Threeleaf violet
24.756	<i>Warea cuneifolia</i>	Carolina warea
24.757	<i>Wolffia columbiana</i>	Common water-meal
24.758	<i>Wolffia papulifera</i>	Papillose water-meal
24.767	<i>Zigadenus glaucus</i>	White camass
24.768	<i>Zigadenus leimanthoides</i>	Pinebarren deathcamus

30.000 Threatened Plants (Endemic, Throughout, and disjunct)

33.360	<i>Isoetes piedmontana</i>	Piedmont quillwort
34.093	<i>Calamagrostis porteri</i>	Porter's reedgrass
34.095	<i>Calamovilfa brevipilis</i>	Riverbank sandreed
34.115	<i>Carex chapmanii</i>	Chapman's sedge
34.162	<i>Cladristis lutea</i>	Yellowwood
34.124	<i>Cymophyllus fraseri</i>	Fraser's sedge
34.219	<i>Diervilla rivularis</i>	Georgia bush-honeysuckle
34.220	<i>Dionaea muscipula</i>	Venus' fly trap
34.237	<i>Echinacea laevigata</i>	Smooth coneflower
34.257	<i>Eroicaulon lineare</i>	Linear pipewort
34.267	<i>Eupatorium resinosum</i>	Resinous joe-pye-weed
34.300	<i>Habenaria flava</i>	Southern rein-orchid
34.301	<i>Habenaria integra</i>	Yellow fringeless-orchid
34.303	<i>Habenaria peramoena</i>	Purple fringeless-orchid
34.315	<i>Helianthus schweinitzii</i>	Schweinitz' sunflower
34.316	<i>Helonias bullata</i>	Swamp-pink
34.330	<i>Hexastylis lewisii</i>	Lewis' heart leaf
34.342	<i>Hydrastis canadensis</i>	Goldenseal
34.354	<i>Ilex amelanchier</i>	Sarvis holly
34.394	<i>Liatris helleri</i>	Heller's gayfeather
34.397	<i>Lilium grayi</i>	Gray's lily
34.457	<i>Myriophyllum laxum</i>	Loose watermilfoil
34.458	<i>Narthecium americanum</i>	Bog-asphodel
34.459	<i>Nestronia umbellula</i>	Nestronia
34.480	<i>Panax quinquefolium</i>	Ginseng
34.551	<i>Prenanthes roanensis</i>	Roan rattlesnakeroot

SPECIAL PLANT SPECIES - Continued

34.560	<i>Ptilimnium fluviatile</i>	Stream mockbishopweed
34.583	<i>Rhododendron bakeri</i>	Cumberland azalea
34.586	<i>Rhododendron vaseyi</i>	Pink-shell azalea
34.589	<i>Rhus michauxii</i>	Michaux sumac
34.610	<i>Rudbeckia heliopsidis</i>	Sun-facing coneflower
34.628	<i>Sarracenia rubra</i>	Sweet pitcher plant
34.630	<i>Saxifraga careyana</i>	Carey saxifrage
34.635	<i>Schisandra glabra</i>	Magnoliavine
34.694	<i>Sporobolus teretifolius</i>	Wireleaf dropseed
34.708	<i>Synandra hispidula</i>	Synandra
34.734	<i>Trillium pusillum</i> var. <i>pusillum</i>	Carolina trillium
34.744	<i>Utricularia olivacea</i>	Dwarf Bladderwort

40.000 Threatened Plants (At Periphery of Range)

43.062	<i>Asplenium pinnatifidum</i>	Lobed spleenwort
43.063	<i>Asplenium resiliens</i>	Blackstem spleenwort
43.081	<i>Botrychium alabamense</i>	Alabama grapefern
43.083	<i>Botrychium lunarioides</i>	Winter grapefern
43.085	<i>Botrychium oneidense</i>	Blunt-lobed grapefern
43.207	<i>Cystopteris bulbifera</i>	Bulblet bladder fern
43.232	<i>Dryopteris celsa</i>	Log fern
43.233	<i>Dryopteris cristata</i>	Crested shield fern
43.236	<i>Dryopteris spinulosa</i>	Spinulose wood fern
43.361	<i>Isoetes riparia</i>	Riverbank quillwort
43.426	<i>Lycopodium porophyllum</i>	Rockspace clubmoss
43.427	<i>Lycopodium selago</i>	Fir clubmoss
43.466	<i>Ophioglossum crotalophoroides</i>	Bulbous adder's-tongue
43.467	<i>Ophioglossum nudicaule</i>	Least adder's-tongue
43.760	<i>Woodsia scopulina</i>	Rocky mountain woodsia

44.008	<i>Agalinis fasciculata</i>	Clustered gerardia
44.022	<i>Alnus crispa</i>	Green alder
44.027	<i>Amorpha schwerinii</i>	Schwerin's amorpha
44.044	<i>Arabis lyrata</i>	Lyre-leaved rockcress
44.049	<i>Arenaria groenlandica</i>	Greenland sandwort
44.773	<i>Aster commixtus</i>	Wood's aster
44.077	<i>Baptisia australis</i>	Blue wild indigo
44.107	<i>Carduus carolinianus</i>	Carolina thistle
44.110	<i>Carex baileyi</i>	Bailey's sedge
44.126	<i>Carex lupuliformis</i>	Hoplike sedge
44.170	<i>Collinsonia verticillata</i>	Whorled horsebalm
44.177	<i>Corallorhiza maculata</i>	Spotted coral-root
44.179	<i>Corallorhiza wisteriana</i>	Spring coral-root
44.186	<i>Corydalis sempervirens</i>	Pale corydalis
44.187	<i>Crataegus aestivalis</i>	May hawthorn
44.188	<i>Crataegus calpodendron</i>	Pear hawthorn
44.198	<i>Cyperus brevifolius</i>	Perennial flatsedge
44.202	<i>Cyperus tetragonus</i>	Four-angled flatsedge
44.223	<i>Disporum maculatum</i>	Nodding manderin

SPECIAL PLANT SPECIES - Continued

44.239	<i>Echinacea purpurea</i>	Purple cone flower
44.241	<i>Echinocystis lobata</i>	Wild mock cucumber
44.247	<i>Eleocharis rostellata</i>	Beaked spike rush
44.249	<i>Elymus riparius</i>	Riverbank wild ryegrass
44.258	<i>Eriocaulon pellucidum</i>	Spotted pipewort
44.259	<i>Eriocaulon septangulare</i>	Seven-angled pipewort
44.273	<i>Fothergilla gardenii</i>	Dwarf fothergilla
44.292	<i>Glyceria pallida</i>	Pale mannagrass
44.302	<i>Habenaria orbiculata</i>	Large round-leaved orchid
44.306	<i>Halodule beaudettei</i>	Beaudette's shoalweed
44.307	<i>Helenium brevifolium</i>	Littleleaf sneezeweed
44.311	<i>Helianthemum rosmarinifolium</i>	Rosemary false sunrose
44.313	<i>Helianthus glaucophyllus</i>	Whiteleaf sunflower
44.326	<i>Heuchera parviflora</i>	Littleleaf alumroot
44.334	<i>Hottonia inflata</i>	Water violet
44.340	<i>Humulus lupulus</i>	Hops
44.343	<i>Hydrocotyle americana</i>	Marsh pennywort
44.350	<i>Hypericum buckleyi</i>	Blue ridge St. John's-wort
44.368	<i>Juncus georgianus</i>	Georgia rush
44.371	<i>Juniperus communis</i> var. <i>depressa</i>	Ground juniper
44.376	<i>Lachnocaulon beyrichianum</i>	Beyrich's bog button
44.398	<i>Lilium philadelphicum</i>	Wood lily
44.412	<i>Lonicera dioica</i>	Limber honeysuckle
44.420	<i>Ludwigia peploides</i> var. <i>glabrescens</i>	Floating marshpurslane
44.444	<i>Meehania cordata</i>	Meehania
44.451	<i>Monotropsis odorata</i>	Carolina beech-drops
44.454	<i>Muhlenbergia sobolifera</i>	Rock muhly
44.460	<i>Nuphar luteum</i> ssp. <i>sagittifolium</i>	European cow-lily
44.470	<i>Opuntia drummondii</i>	Drummond's Prickly pear
44.484	<i>Panicum linearifolium</i>	Slimleaf panicgrass
44.490	<i>Parnassia asarifolia</i>	Brook parnassia
44.491	<i>Parnassia caroliniana</i>	Carolina parnassia
44.500	<i>Peltandra sagittaeifolia</i>	Arrowleaf shieldwort
44.510	<i>Phacelia ranunculacea</i>	Buttercup phacelia
44.518	<i>Pieris floribunda</i>	Fetterbush
44.526	<i>Planera aquatica</i>	Planer-tree
44.539	<i>Polymnia canadensis</i>	Leaf-cup
44.543	<i>Potamogeton amplifolius</i>	Largeleaf pondweed
44.544	<i>Potamogeton confervoides</i>	Conferva pondweed
44.545	<i>Potamogeton folioisus</i>	Leafy pondweed
44.548	<i>Potamogeton nodosus</i>	American pondweed
44.550	<i>Potentilla tridentata</i>	Windleaf cinquefoil
44.555	<i>Psoralea lupinellus</i>	Lupine scurfpea
44.566	<i>Quercus ilicifolia</i>	Bear oak
44.602	<i>Rhynchospora odorata</i>	Fragrant beakrush
44.608	<i>Rubus idaeus</i> var. <i>canadensis</i>	Red raspberry
44.616	<i>Sagittaria calycina</i>	California arrowhead
44.621	<i>Salvia azurea</i>	Azure sage
44.640	<i>Scirpus cespitosus</i> var. <i>callosus</i>	Deerhair bulrush
44.652	<i>Sebastiania ligustrina</i>	Sebastian-bush
44.653	<i>Sedum nevii</i>	Cliff stonecrop
44.667	<i>Silene ovata</i>	Mountain catchfly
44.684	<i>Solidago uliginosa</i>	Bog goldenrod
44.697	<i>Stellaria corei</i>	Core's starwort

SPECIAL PLANT SPECIES - Continued

44.728	Tridens carolinianus	Carolina triodia
44.729	Tridens strictus	Spike triodia
44.739	Typha glauca	Blue cattail
44.749	Veronica americana	American speedwell
44.763	Xyris brevifolia	
44.764	Xyris elliotii	Elliott's yellow-eyed grass

50.000 Extinct Vascular Plants

54.072	Astilbe crenatiloba	Roan false goat's beard
54.105	Cardamine micranthera	Small-anthered bittercress
54.277	Gale palustris	Sweet gale
54.401	Lindermia saxicola	Rock false pimpernel
54.556	Psoralea macrophylla	Bigleaf scurfpea
54.677	Solidago porteri	Porter's goldenrod

PHYSICAL FEATURES (PF)

01.000 Landscape Features Related to Internal Processes

01.100 Tectonic Activity

- 01.110 Faults
 - 01.111 Active
 - 01.112 Inactive
- 01.120 Fault Valley
- 01.130 Fault-line Scarp
- 01.140 Terraces due to tectonic uplift
- 01.150 Sediment deformation
- 01.160 Thrust Window (Fenster)
- 01.170 Thrust Sheet (Nappe)

01.200 Fold Forms

- 01.210 Anticline
- 01.220 Syncline
- 01.230 Homocline
- 01.240 Dome
- 01.250 Cuesta
- 01.260 Hogback

01.300 Intrusive Igneous Forms

- 01.310 Dike
- 01.320 Sill
- 01.330 Massive pluton
- 01.340 Vent (Plug, Ring dike)
- 01.350 Unusual igneous form

01.400 Extrusive Igneous Forms

- 01.410 Lava
- 01.420 Pillow lava
- 01.430 Pyroclastic deposits
- 01.440 Volcanic Ash
- 01.450 Miscellaneous volcanic deposits

01.500 Thermal Springs

PHYSICAL FEATURES - Continued

02.000 Fossils

- 02.100 Fossils - Precambrian
- 02.200 Fossils - Age of Primitive Vertebrates
(Cambrian-Silurian)
- 02.300 Fossils - Rise of vertebrates and early forest
(Devonian-Permian)
- 02.400 Fossils - Age of Reptiles (Mesozoic)
- 02.500 Fossils - Age of emerging dominance of mammals
(Tertiary-Quaternary)

03.000 Landscape Features Due to External Processes

03.200 Landscape Due to Differential Weathering

- 03.210 Monadnock
 - 03.211 Monadnock-Bornhardt
 - 03.222 Monadnock-Nonspheroidal Masses
- 03.220 Flatrocks
- 03.230 Features shaped by breaching veneered or case-hardened surfaces on a monolith
- 03.240 Tors (upland boulder field)
- 03.250 Erosional Scarp
- 03.260 Peneplain
- 03.270 Talus slope

03.300 Landscape Due to Fluvial Processes

- 03.310 Meanders
- 03.320 Relict stream gravel
- 03.330 Alluvial fan
- 03.340 Whitewater (rapids)
- 03.350 Waterfall
- 03.360 Stream gorge
- 03.370 Potholes
- 03.380 Rock Arch
- 03.390 Sinkhole

04.000 Cave

PHYSICAL FEATURES Continued

05.000 Coastal Features

- 05.100 Coastal Terrace
- 05.200 Carolina Bay
- 05.300 Barrier island system
 - 05.310 Barrier island
 - 05.320 Spit
 - 05.330 Inlet
 - 05.340 Washover fan
 - 05.350 Relict inlet
 - 05.360 Relict beach ridge
 - 05.370 Relict spit
 - 05.380 Dunes
 - 05.381 Beach ridge vegetated dunes
 - 05.382 Nonvegetated dunes
- 05.400 Carolina Cape
- 05.500 Reef
 - 05.510 Coral reef
 - 05.520 Submerged rock outcrop
- 05.600 Mud and sand flat
- 05.700 Clay and sand bank (shoreline scarp)
- 05.800 Marine scarp (relict shoreline scarp)
- 05.900 Sound, Bay, Lagoon

06.000 Other features of Ecological Importance

- 06.100
- 06.200 Cove, glen
- 06.300 Cliff, bluff, outcrop

07.000 Major Regional Features

- 07.100 Fall Zone
- 07.200 Blue Ridge Escarpment
- 07.300 Continental Shelf Break

PHYSICAL FEATURES - Continued

08.000 Meteor Impact Site

11.000 Natural Lake

15.000 Wetlands

15.100 Fresh marsh

15.200 Salt marsh

15.300 Swamp

15.310 Bay swamp

15.320 Estuarine swamp

15.330 Lake swamp

15.340 Marine swamp

15.350 River swamp

15.360 Sink swamp

15.370 Tidal swamp

15.400 Seasonally flooded bottomland

15.500 Bog

16.000 Major Free-Flowing River ("Wild or Scenic River")

PLANT
COMMUNITY TYPES

A Suggested Coding System for Data Banking
(Complete for (c) and (q) only in eastern United States)

CONIFERS OR GYMNOSPERMS (c)
CUPRESSACEAE

- c1. *Chamaecyparis thyoides* (L.) B.S.P. Atlantic white cedar
- c2. *Juniperus ashei* Buchholz Ashe Juniper
- c3. *J. communis* L. Common Juniper
- c4. *J. silicicola* (Small) Bailey Southern red cedar SAF-73
- c5. *J. virginiana* L. Eastern red cedar SAF-46
- c6. *Thuja occidentalis* L. Northern white cedar SAF-37

PINACEAE

- c7. *Abies balsamea* (L.) Mill. Balsam fir SAF-5
- c8. *A. fraseri* (Pursh) Poir. Fraser fir
- c9. *Larix laricina* (DuRoi) K. Koch Tamarack SAF-38
- c10. *Picea glauca* (Moench) Voss White spruce SAF-201
- c11. *P. mariana* (Mill.) B.S.P. Black spruce SAF-204
- c12. *P. rubens* Sarg. Red spruce SAF-32
- c13. *Pinus banksiana* Lamb. Jack pine SAF-1
- c14. *P. clausa* (Chapm.) Vasey Sand pine SAF-69
- c15. *P. echinata* Mill. Shortleaf pine SAF-75
- c16. *P. elliotii* Engelm. Slash pine SAF-84
- c17. *P. elliotii* var. *densa* Little & Dorman South Florida slash pine
- c18. *P. glabra* Walt. Spruce pine
- c19. *P. palustris* Michx. F. Longleaf pine SAF-70
- c20. *P. pungens* Lamb. Table-Mountain pine
- c21. *P. resinosa* Ait. Red pine SAF-15
- c22. *P. rigida* Mill. Pitch pine SAF-45
- c23. *P. serotina* Michx. Pond pine SAF-98
- c24. *P. strobus* L. Eastern white pine SAF-21
- c25. *P. taeda* L. Loblolly pine SAF-81
- c26. *P. virginiana* Mill. Virginia pine SAF-79
- c27. *Tsuga canadensis* (L.) Carr Eastern hemlock SAF-23
- c28. *T. caroliniana* Engelm. Carolina hemlock

TAXACEAE

- c29. *Taxus floridana* Nutt. Florida yew
- c30. *Torreya taxifolia* Arn. Florida Torreya

COMMUNITY TYPES - Continued

TAXODIACEAE

- c31. *Taxodium distichum* (L.) Rich. Bald cypress SAF-101
- c32. *T. distichum* var. *nutans* (Ait.) Sweet Pond Cypress SAF-100

MIXED GYMNOSPERMS

- c33. White cedar-Pond pine
- c34. Eastern hemlock-Carolina hemlock
- c35. Jack pine-Black spruce SAF-6
- c36. Loblolly pine-Eastern red cedar SAF-47
- c37. Longleaf pine-Loblolly pine
- c38. Longleaf pine-Pond pine
- c39. Longleaf pine-Slash pine SAF-83
- c40. Pitch pine-Table Mountain pine
- c41. Pitch pine-Virginia pine
- c42. Shortleaf pine-Loblolly pine SAF-80
- c43. Shortleaf pine-Spruce pine
- c44. Shortleaf pine-Virginia pine SAF-77
- c45. Eastern white pine-Eastern hemlock SAF-22
- c46. White pine-Carolina hemlock
- c47. Black spruce-Balsam Fir SAF-7
- c48. Black spruce-White spruce SAF-2
- c49. Black spruce-Tamarack SAF-13
- c50. Red spruce-Balsam fir SAF-33
- c51. Red spruce-Fraser fir SAF-34
- c52. White spruce-Balsam fir SAF-4

MIXED CONIFER-OAK

- c53. Carolina hemlock-Scarlet oak
- c54. Eastern white pine-Chestnut oak SAF-51
- c55. Eastern white pine-Northern red oak SAF-20
- c56. Eastern white pine-White oak
- c57. Loblolly pine-Blackjack oak
- c58. Loblolly pine-Mixed oak
- c59. Longleaf pine-Blackjack oak
- c60. Longleaf pine-Bluejack oak
- c61. Longleaf pine-Turkey oak SAF-71
- c62. Shortleaf pine-Mixed oak SAF-76
- c63. Slash pine-Live oak
- c64. Slashpine-Mixed oak
- c65. Virginia pine-Scarlet oak
- c66. Virginia pine-Southern red oak SAF-78

COMMUNITY TYPES - Continued

MIXED CONIFER-HARDWOOD

- c67. Eastern red cedar-Mixed hardwoods SAF-48
- c68. Bald cypress-Water tupelo SAF-102
- c69. Pond cypress-Swamp tupelo
- c70. Eastern hemlock-Beech
- c71. Eastern hemlock-Mixed hardwoods
- c72. Eastern hemlock-Yellow birch SAF-24
- c73. Jack pine-Aspen SAF-8
- c74. Loblolly pine-Mixed hardwoods SAF-82
- c75. Pond pine-Loblolly bay
- c76. Pond pine-Red maple-Swamp tupelo
- c77. Pond pine-Sweetbay-Red bay
- c78. Slash pine-Cabbage palmetto SAF-86
- c79. Slash pine-Swamp tupelo SAF-99
- c80. Red spruce-Balsam fir-Paper birch SAF-35
- c81. Red spruce-Yellow birch SAF-30
- c82. White spruce-Balsam fir-Paper birch SAF-36

MIXED CONIFER-OAK-HARDWOOD

- c83. White pine-Northern red oak-White ash SAF-20

QUERCINE SPECIES (OAKS AND HICKORIES) (q)
FAGACEAE

- q1. *Quercus alba* L. White oak SAF-53
- q2. *Q. bicolor* Willd. Swamp white oak
- q3. *Q. caput-rivuli* Ashe Arkansas oak
- q4. *Q. coccinea* Muenchh. Scarlet oak SAF-41
- q5. *Q. durandii* Buckl. Bastard white oak
- q6. *Q. ellipsoidalis* E. J. Hill Northern pin oak
- q7. *Q. falcata* Michx. Southern red oak
- q8. *Q. falcata* var. *pagodaefolia* Ell. Cherry bark oak
- q9. *Q. georgiana* M. A. Curtis Georgia oak
- q10. *Q. hemisphaerica* Bartr. Darlington oak
- q11. *Q. ilicifolia* Wangeng. Bear oak
- q12. *Q. imbricaria* Michx. Shingle oak
- q13. *Q. incana* Bartr. Bluejack oak
- q14. *Q. laevis* Walt. Turkey oak
- q15. *Q. laurifolia* Michx. Laurel oak
- q16. *Q. lyrata* Walt. Overcup oak
- q17. *Q. macrocarpa* Michx. Bur oak SAF-42
- q18. *Q. marilandica* Muenchh. Blackjack oak
- q19. *Q. michauxii* Nutt. Swamp chestnut oak
- q20. *Q. muehlenbergii* Engelm. Chinkapin oak

COMMUNITY TYPES - Continued

- q21. *Q. nigra* L. Water oak
- q22. *Q. Nuttallii* Palmer Nuttall oak
- q23. *Q. oglethorpensis* Duncan Oglethorpe oak
- q24. *Q. palustris* Muenchh. Pin oak
- q25. *Q. phellos* L. Willow oak
- q26. *Q. prinus* L. Chestnut oak SAF-44
- q27. *Q. rubra* L. Red oak SAF-55
- q28. *Q. rubra* var. *borealis* (Michx. f.) Farw. Northern red oak
- q29. *Q. shumardii* Buckl. Shumard oak
- q30. *Q. stellata* Wangenh. Post oak
- q31. *Q. stellata* var. *margaretta* (Ashe) Sarg. Scrub post oak
- q32. *Q. velutina* Lam. Black oak
- q33. *Q. virginiana* L. Live oak SAF-89

JUGLANDACEAE

- q34. *Carya aquatica* (Michx. f.) Nutt.
- q35. *C. carolinae-septentrionalis* (Ashe) Engler & Graebner Southern shagbark
- q36. *C. cordiformis* (Wangenh.) K. Koch Bitternut hickory
- q37. *C. glabra* (Mill.) Sweet Pignut hickory
- q38. *C. illinoensis* (Wangenh.) K. Koch Pecan
- q39. *C. laciniosa* (Michx. f.) Loud. Shellbar hickory
- q40. *C. myristicaeformis* (Michx. f.) Nutt. Nutmeg hickory
- q41. *C. ovalis* (Wangenh.) Sarg. Sweet pignut hickory
- q42. *C. ovata* (Mill.) K. Koch Shagbark hickory
- q43. *C. pallida* (Ashe) Engler & Graebner Pale hickory
- q44. *C. texana* Buckl. Black hickory
- q45. *C. tomentosa* Nutt. Mockernut hickory
- q46. Blackjack oak-Black oak
- q47. Blackjack oak-Post oak
- q48. Black oak-Post oak SAF-40
- q49. Black oak-White oak
- q50. Cherrybark oak-Willow oak
- q52. Chestnut oak-Blackjack oak
- q53. Laurel oak-Pale hickory
- q54. Laurel oak-Southern red oak
- q55. Laurel oak-Willow oak SAF-88
- q56. Live oak-Laurel oak
- q57. Mixed hickory
- q58. Mixed oak
- q59. Mixed oak-Hickory
- q60. Overcup oak-Water hickory SAF-96
- q61. Pin oak-Overcup Oak
- q63. Southern red oak-Pale hickory
- q64. Southern red oak-Mockernut hickory
- q65. Southern red oak-Water oak
- q66. Swamp chestnut oak-Cherrybark oak SAF-91
- q67. Swamp chestnut oak-Overcup oak
- q68. Swamp chestnut oak-Willow oak
- q69. Turkey oak-Bluejack oak SAF-72
- q70. Turkey oak-Scrub post oak

COMMUNITY TYPES - Continued

- q71. Turkey oak-Scrub post oak-Bluejack oak SAF-72
- q72. White oak-Chestnut oak
- q73. White oak-Mockernut hickory
- q74. White oak-Northern red oak
- q75. White oak-Post oak
- q76. White oak-Red oak-Hickory
- q77. White oak-Southern red oak
- q78. Willow oak-Oglethorpe oak
- q79. Willow oak-Overcup oak
- q80. Willow oak-Overcup oak-Swamp chestnut oak

MIXED OAK-CONIFER (See Conifer-Oak)

- q81. Chestnut oak-Scrub pine
- q82. Laurel oak-Loblolly pine
- q83. Laurel oak-Slash pine
- q84. Laurel oak-Spruce pine
- q85. Mixed oak-Loblolly pine
- q86. Southern red oak-Loblolly pine
- q87. Scarlet oak-Pitch pine
- q88. Water oak-Pond pine
- q89. Willow oak-Loblolly pine

MIXED OAK-HARDWOODS

- q90. Live oak-Cabbage palmetto SAF-74
- q91. Northern red oak-Basswood SAF-54
- q92. Northern red oak-Mixed hardwoods
- q93. Northern red oak-Mockernuthichory-Sweetgum SAF-56
- q94. Northern red oak-Yellow birch
- q95. Nuttall oak-Willow oak-Sweetgum SAF-92
- q96. Pin oak-Sweetgum SAF-92
- q97. Red oak-Mixed hardwoods
- q98. White oak-Mixed hardwoods
- q99. Willow oak-Mixed southern hardwoods

HARDWOODS (h)

(Non-quercine angiosperm woody species)
(Selected)

ACERACEAE

- h1. *Acer negundo* L. Boxelder
- h2. *A. pensylvanicum* L. Striped maple
- h3. *A. rubrum* L. Red maple
- h4. *A. rubrum* var. *drummondii* (H. & A.) Sarg. Swamp red maple
- h5. *A. rubrum* var. *trilobum* K. Koch Bay red maple

COMMUNITY TYPES - Continued

- h6. *A. saccharinum* L. Silver maple
- h7. *A. saccharum* Marsh. Sugar maple
- h8. *A. saccharum* ssp. *floridanum* (Chapm.) Desmarais Southern sugar maple
- h9. *A. saccharum* ssp. *leucoderme* (Small) Desmarais Chalk maple
- h10. *A. saccharum* ssp. *nigrum* (Michx. f.) Desmarais Black maple
- h11. *A. spicatum* Lam. Mountain maple

ANACARDIACEAE

- h12. *Rhus copallina* L. Winged sumac
- h13. *R. typhina* L. Staghorn sumac
- h14. *R. vernix* L. Poison sumac

ANNONACEAE

- h15. *Asimina triloba* (L.) Dunal Pawpaw

AQUIFOLIACEAE

- h16. *Ilex cassine* L. Dahoon
- h17. *I. decidua* Walt. Posum haw
- h18. *I. krugiana* Loesener Krug holly
- h19. *I. montana* T. & G. Mountain holly
- h20. *I. opaca* Ait. American holly
- h21. *I. vomitoria* Ait. Yaupon

ARALIACEAE

- h22. *Aralia spinosa* L. Hercules club

BETULACEAE

- h23. *Alnus maritima* (Marsh.) Nutt. Seaside alder
- h24. *Betula alleghaniensis* Britt. Yellow birch
- h25. *B. lenta* L. Black birch
- h26. *B. nigra* L. River birch
- h27. *B. papyrifera* Marsh. Paper birch
- h28. *B. populifolia* Marsh. Gray birch
- h29. *B. uber* (Ashe) Fern.
- h30. *Carpinus caroliniana* L. Ironwood
- h31. *Ostrya virginiana* (Mill.) K. Koch Hop hornbeam

COMMUNITY TYPES - Continued

CORNACEAE

- h32. *Cornus alternifolia* L. f. Alternate-leaved dogwood
- h33. *C. asperifolia* Michx.
- h34. *C. florida* L. Flowering dogwood
- h35. *C. foemina* Mill. Swamp dogwood

CYRILLACEAE

- h36. *Cyrilla racemiflora* L. Titi

EBENACEAE

- h37. *Diospyros virginiana* L. Persimmon

ERICACEAE

- h38. *Oxydendrum arboreum* (L.) dc. Sourwood

EUPHORBIACEAE

- h39. *Sapium sebiferum* (L.) Roxb. Milktree

FABACEAE

- h40. *Cercis canadensis* L. Redbud
- h41. *Cladrastis lutea* (Michx. f.) K. Koch Yellowwood
- h42. *Gleditsia aquatica* Marsh. Water locust
- h43. *G. triacanthos* L. Honey locust
- h44. *Gymnocladus dioica* (L.) Koch Kentucky coffee tree
- h45. *Robinia pseudo-acacia* L. Black locust

FAGACEAE

- h46. *Fagus grandifolia* Ehrh. Beech

HAMAMELIDACEAE

- h47. *Hamamelis virginiana* L. Witch hazel
- h48. *Liquidambar styraciflua* L. Sweet gum

COMMUNITY TYPES - Continued

HIPPOCASTANACEAE

- h49. *Aesculus glabra* Willd. Ohio buckeye
- h50. *A. octandra* Marsh. Yellow buckeye
- h51. *A. parviflora* Walt. Bottlebrush buckeye
- h52. *A. pavia* L. Red buckeye
- h53. *A. sylvatica* Bartr. Painted buckeye

JUGLANDACEAE

- h54. *Juglans cinerea* L. Butternut
- h55. *J. nigra* L. Black walnut

LAURACEAE

- h56. *Persea borbonia* (L.) Spreng. Red bay
- h57. *P. humilis* Nash Silk bay
- h58. *P. palustris* (Raf.) Sarg. Swamp red bay

SHRUB COVER TYPES
(Selected)

CAPRIFOLIACEAE

- s1. *Viburnum alnifolium* Marshall Moosewood
- s2. *V. acerifolium* L. Maple-leaved viburnum

CLUSIACEAE

- s3. *Hypericum fasciculatum* Lam.
- s4. *J. frondosum* Michaux

ERICACEAE

- s5. *R. calendulaceum* (Michaux) Torrey Flame azalea
- s6. *Rhododendrom catawbiense* Michaux Purple Laurel
- s7. *Vaccinium arboreum* Marshall Sparkleberry
- s8. *V. macrocarpon* Aiton Cranberry
- s9. *Zenobia pulverulenta* (Bartram) Pollard Zenobia

OLEACEAE

- s10. *Forestiera ligustrina* (Michaux) Poiret

COMMUNITY TYPES - Continued

GRAMINOID COVER TYPES
(Selected)

CYPERACEAE

- g1. *Carex pensylvanica* Lam.
- g2. *C. plantaginea* Lam.
- g3. *C. walteriana* Bailey
- g4. *Cladium jamaicense* Crantze Sawgrass
- g5. *C. mariscoides* (Muhl.) Torrey Twig-rush
- g6. *Dichromena colorata* (L.) Hitchcock Whitetop sedge
- g7. *D. latifolia* Baldwin
- g8. *Dulichium arundinaceum* (L.) Britton Three-way sedge
- g9. *Eleocharis acicularis* (L.) R. & S. Slender spike-rush
- g10. *E. albida* Torr. Saltmarsh spike-rush
- g11. *E. cellulosa* Torrey Gulf spike-rush
- g12. *E. equisetoides* (ELL.) Torrey Northern jointed spike-rush
- g13. *E. interstincta* (Vahl) R. & S. Southern jointed spike-rush
- g14. *E. obtusa* (Willd.) Schultes Blunt spike-rush
- g15. *E. palustris* (L.) R. & S. Common spike-rush
- g16. *E. parvula* (R. & S.) Link Dwarf spike-rush
- g17. *E. quadrangulata* (Michaux) R. & S. Squarestem spike-rush
- g18. *E. robbinsii* Oakes Trianglestem spike-rush
- g19. *E. rostellata* Torrey Walking spike-rush
- g20. *Eriophorum virginicum* L. Cotton grass
- g21. *Fimbristylis spadicea* (L.) Vahl Saltmarsh Fimbristylis
- g22. *Fuirena scirpoidea* Michaux Umbrella grass
- g23. *Rhynchospora corniculata* (Lam.) Gray Horned rush
- g24. *R. inundata* (Oakes) Fernald
- g25. *R. macrostachya* Torrey Large spiked horned rush
- g26. *R. tracyi* Britton Everglades beaked rush
- g27. *Scirpus acutus* Muhl. Hardstem bulrush
- g28. *S. americanus* Persoon Three-square
- g29. *S. atrovirens* Willd.
- g30. *S. cespitosus* var. *callosus* Bigelow Tussock bulrush
- g31. *S. cyperinus* (L.) Kunth Wool grass
- g32. *S. etuberculatus* (Steudel) Kuntze Swamp bulrush
- g33. *S. expansus* Fernald
- g34. *S. olneyi* Gray Olney three-square
- g35. *S. purshianus* Fernald Soft bulrush
- g36. *S. robustus* Pursh Brachish marsh bulrush
- g37. *S. subterminalis* Torrey Swaying rush
- g38. *S. validus* Vahl Softstem bulrush

JUNCACEAE

- g39. *Juncus effusus* L. Soft rush
- g40. *J. roemerianus* Scheele Needlerush

COMMUNITY TYPES - Continued

POACEAE

- g41. *Ammophila breviligulata* Fernald American Beachgrass
- g42. *A. eliottii* Chapm. Elliott beardgrass
- g43. *A. gerardii* Vitman. Big bluestem
- g44. *A. glomeratus* (Walt.) B.S.P. Bushy beardgrass
- g45. *Andropogon scoparius* Michx. Little bluestem
- g46. *A. ternarius* Michx.
- g47. *A. virginicus* L. Broomsedge
- g48. *Aristida stricta* Michx. Pineland three-awn
- g49. *Aundinaria gigantea* (Walt.) Muhl. Giant Cane
- g50. *A. tecta* (Walt.) Muhl. Switch Cane
- g51. *Ctenium aromaticum* (Walt.) Wood. Toothache grass
- g52. *Danthonia compressa* Austin
- g53. *Distichlis spicata* (L.) Greene Seashore saltgrass
- g54. *Elymus virginicus* L. Virginia wild-rye
- g55. *Erianthus giganteus* (Walt.) Muhl. Sugarcane plumegrass
- g56. *F. myuros* L.
- g57. *F. obtusa* Vieler Nodding fescue
- g58. *Festuca octoflora* Walt. Six-weeks fescue
- g59. *F. paradoxa* Desv.
- g60. *F. sciurea* Nutt.
- g61. *Glyceria acutiflora* Torr.
- g62. *G. arkansana* Fernald
- g63. *G. obtusa* (Muhl.) Trin.
- g64. *G. septentrionalis* Hitchc. Eastern Mannagrass
- g65. *G. striata* (Lam.) Hitchc. Fowl mannagrass
- g66. *Hydrochloa caroliniensis* Beauv.
- g67. *Leersia hexandra* Swartz
- g68. *Leptoloma cognatum* (Schult.) Chase Fall witchgrass
- g69. *Monanthochloe littoralis* Englem.
- g70. *Muhlenbergia capillaris* (Lam.) Trin.
- g71. *M. filipes* M. A. Curtis
- g72. *P. amarum* Ell.
- g73. *P. hemitomom* Schult. Maidencane
- g74. *Panicum virgatum* L. Switchgrass
- g75. *Phalaris arundinacea* L. Reed Canary grass
- g76. *Phragmites communis* Trin. Common reed
- g77. *Puccinellia maritima* (Huds.) Parl.
- g78. *Setaria magna* Griseb. Giant bristlegrass
- g79. *Sorghastrum nutans* (L.) Nash Indian grass
- g80. *S. alterniflora* Loisel. Smooth cordgrass
- g81. *S. bakeri* Merr.
- g82. *S. cynosuroides* (L.) Roth. Big cordgrass
- g83. *S. patens* (Ait.) Muhl. Saltmeadow cordgrass
- g84. *Spartina pectinata* Link. Prairie cordgrass
- g85. *Sporobolus virginicus* (L.) Kunth
- g86. *Tridens flavus* (L.) Hitchc. Purpletop
- g87. *T. americana* Beauv. American sandgrass
- g88. *Triplasis purpurea* (Walt.) Chapm. Purple sandgrass
- g89. *Uniola paniculata* L. Sea Oats
- g90. *Zizania aquatica* L. Annual wildrice
- g91. *Zizaniopsis miliacea* (Michx) Doell and Aschers. Southern wildrice

COMMUNITY TYPES - Continued

FERN COVER TYPES
(Selected)

- f1. *Anchistea virginica* (L.) Presl Virginia chain fern
- f2. *Athyrium asplenoides* (Michx.) A. A. Eaton Lady fern
- f3. *A. pycnocarpon* (Spreng.) Tidestrom Glade fern
- f4. *A. thelypteroides* (Michaux) Desv. Silvery spleenwort
- f5. *Azolla caroliniana* Willd. Mosquito fern
- f6. *Cheilanthes lanosa* (Michaux) D. C. Eaton Hairy lipfern
- f7. *C. tomentosa* Link Woolly lipfern
- f8. *Dennstaedtia punctilobula* (Michaux) Moore Hay-scented fern
- f9. *Dryopteris campyloptera* Clarkson Mountain woodfern
- f10. *D. intermedia* (Willd.) Gray Fancy fern
- f11. *Equisetum hyemale* var. *affine* (Engelm.) A. A. Eaton Scouring rush
- f12. *Isoetes melanopoda* Gay & Dur. Rock quillwort
- f13. *I. engelmannii* A. Br.
- f14. *Lycopodium flabelliforme* (Fernald) Blanchard Ground cedar
- f15. *L. clavatum* L. Running cedar
- f16. *Osmunda cinnamomea* L. Cinnamon fern
- f17. *O. regalis* var. *spectabilis* (Willd.) Gray Royal Fern
- f18. *Pteridium aquilinum* (L.) Kuhn Bracken
- f19. *Selaginella rupestris* (L.) Spring Rock spikemoss
- f20. *S. tortipila* A. Br. Twisted hair spikemoss
- f21. *Trichomanes boschianum* Sturm ex Bosch Bristle fern
- f22. *T. petersii* Gray Dwarf filmy fern
- f23. *Woodwardia virginica* (L.) Smith Virginia chain fern

VASCULAR AQUATIC COVER TYPES
(Selected)

HALORAGACEAE

- a1. *Myriophyllum heterophyllum* Michaux Water milfoil
- a2. *M. Laxum* Shuttlew. ex Chapman Dwarf water milfoil

NAJADCEAE

- a3. *Najas guadalupensis* (Sprengel) Magnus Bushy pondweed

NELUMBONACEAE

- a4. *Nelumbo lutea* (Willd.) Persoon Yellow nelumbo
- a5. *N. nucifera* Gaertner Sacred lotus

COMMUNITY TYPES -- Continued

NYMPHAEACEAE

- a6. *Nuphar luteum* (L.) Sibthorp & Smith Spatter-dock
- a7. *Nymphaea odorata* Aiton Water-lily

POTAMOGETONACEAE

- a8. *Potamogeton crispus* L.
- a9. *P. diversifolius* Raf.
- a10. *P. pectinatus* L. Sago pondweed

ZOSTERACEAE

- all. *Ruppia maritima* L. Ditch grass
- al2. *Zostera marina* L. Eelgrass

PIONEER ANNUAL COVER TYPES
(Selected)

AIZOACEAE

- p1. *Mollugo verticillata* L. Carpet weed

BRASSICACEAE

- p2. *Draba verna* L. Whitlow grass
- p3. *Leavenworthia torulosa* A. Gray
- p4. *L. uniflora* (Michaux) Britt.

CARYOPHYLLACEAE

- p5. *Arenaria groenlandica* var. *glabra* (Michaux) Fernald
- p6. *Arenaria uniflora* (Walter) Muhl. Rockwort
- p7. *Spergularia marina* (L.) Grisebach Sand spurrey

CHENOPODIACEAE

- p8. *Salicornia bigelovii* Torr. Dwarf saltwort
- p9. *Suaeda maritima* (L.) Dumort Sea-blite

CRASSULACEAE

- p10. *Diamorpha smallii* Britton
- p11. *Sedum pusillum* Michaux Small stonecrop

COMMUNITY TYPES - Continued

PERENNIAL FORB COVER TYPES
(Selected)

AIZOACEAE

- z1. *Sesuvium maritimum* (Walt.) B.S. P. Sea purslane

ASTERACEAE

- z2. *Aster pilosus* Willd. Frost aster
z3. *A. puniceus* L. Bottomland aster
z4. *Solidage nemoralis* Ait.

BRASSICACEAE

- z5. *Cardamine bulbosa* (Schreber) B.S. P. Spring cress

LILIACEAE

- z6. *Camassia scilloides* (Raf.) Cory Wild hyacinth
z7. *Erythronium americanum* Ker Trout lily

RANUNCULACEAE

- z8. *Delphinium tricornes* Michaux Larkspur
z9. *Ranunculus laxicaulis* (T. & G.) Darby
z10. *Thalictrum polygamum* Muhl. Meadow rue

SARRACENIACEAE

- z11. *Sarracenia flava* L. Trumpet

URTICACEAE

- z12. *Laportea candensis* (L.) Weddell Wood nettle

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